HEALTH

FOR

THE PEOPLE

By Dr ANDREW WILSON, F.R S.E.

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ANDREW WILSON, F.R.S.E., ETC.

EDITOR OF "HEALTH"

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TO

MY FRIEND DAN,

I DEDICATE

THIS LITTLE VOLUME,

IN REMEMBRANCE OF MANY PLEASANT SYMPOSIA

ON SUBJECTS CONNECTED WITH

MIND AND MATTER.

A. W.

PREFACE.

This volume consists of a series of original essays contributed to *Health*. These papers have been reprinted, in the hope that, in a collected and readily accessible form, they may serve as a means of stimulating an increased interest in topics relating to the preservation of individual and public health.

CONTENTS.

HEALTH FOR THE PEOPLE.

A HEART IN THE WRONG PLACE.

Amongst the veritable curiosities of human existence, may certainly be numbered those by no means common cases in which the organs of the body are found misplaced by nature, as it were, and occupying situations of unusual and unlikely kind within the frame. The phrases "having a heart in the right place," and its opposite, have each their anatomical side; for there are cases known in which, so far from the heart having occupied its usual position, the organ has been found very far removed from its natural region. Cases of "floating kidneys," again, figure in the list of anatomical irregularities, and occasionally a complete transposition of the internal organs may be met with in the *post-mortem* room, or may even be made out during the patient's life.

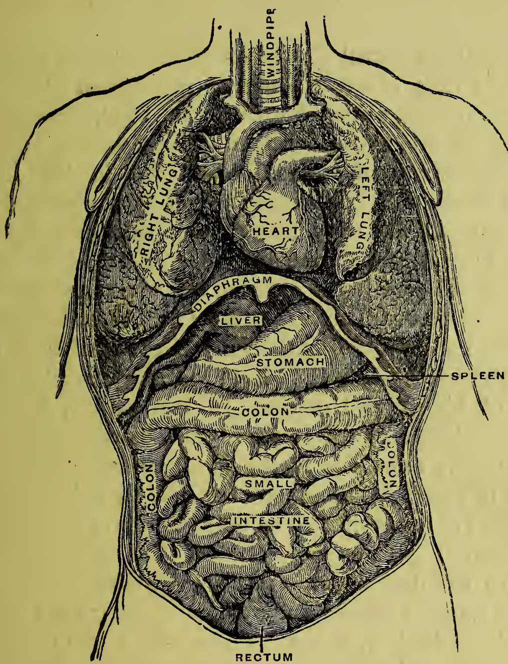
It can readily be understood how interesting and important these cases of alteration—or, as it is technically named, *malposition*—of the body's organs become, when we reflect that the diagnosis of disease is often thereby rendered a task of highly complex and difficult nature. If, when examining his patient, a doctor finds dulness and solidity, where he expects naturally to meet with the reverse conditions, the medical man is apt at once to suspect the existence of either abnormality or disease. A liver placed on the left instead of the right side of the body, for example, might seriously complicate a medical examination,

when, as might be likely, the idea of "malposition" of bodily organs has never entered the doctor's mind. A heart shifted from its place, may, it is true, be so moved by disease; but when we reflect that this organ may be "malposed" by nature, we see the need which exists for medical science to thoroughly investigate all cases in which any alteration of the bodily structure is suspected. Even certain organs may be wanting or undeveloped. In a case recently reported, the spleen was wanting, and this fact alone teaches us how curious are the ways and works of arrested or altered development in its effects on the animal frame. Life, it would seem, is quite compatible with the serious alteration or even absence of organs and parts which are popularly esteemed as absolutely essential to the performance of vital functions, and to the maintenance of the body's existence as a whole.

To properly understand the nature of the curious facts which an excursion into anatomical byways may reveal, we must firstly glance at the natural position of the body's organs. As shown in our illustration, where the front wall of the body has been removed, the organs of the chest and abdomen occupy definite positions and exhibit stable anatomical relations to one another. The *thorax* or chest, as every one knows, contains the *lungs*, one on each side, with the *heart*, contained in its bag or *pericardium*, lying between them, The chest itself, is completely shut off from the *abdomen*, or lower cavity of the trunk, by a broad muscle. This is the *midriff* or *diaphragm*. It forms at once the arched or convex floor of the chest, and the concave roof of the abdomen; and is the chief agent in the work of taking in a breath. By the descent and contraction of the diaphragm, the chest is enlarged, and we are enabled to inspire. "Hiccough" is due to the spasmodic action of this great muscle.

Only quadrupeds or *mammals* have this division of the body into two compartments, it may be noted—birds and reptiles, frogs and fish, to descend into the Vertebrate group, having the

body all in one cavity, so to speak, and not possessing a chest separated from the abdomen, as in man and his neighbour mammals. The *abdomen* contains the digestive organs, together with the kidneys and spleen. The relations of these organs to each other are well shown in the illustration. Thus, the



VIEW OF THE INTERNAL ORGANS IN POSITION, AS SEEN FROM THE FRONT.

stomach, in man a pear-shaped bag (with the large end of the pear lying to the left side) occupies a middle position. The *liver*, weighing between 3lb. and 4lb., and forming the largest gland in the body, lies to the right side of the body, viewing the body from the front. The *spleen*, a blood-gland devoted to

the elaboration of that fluid, lies to the left of the stomach, while the *pancreas* (or "sweetbread") lies somewhat below, and behind the latter organ. The remainder of the abdominal cavity is occupied by the *intestine* (or bowel), measuring about twenty-six feet in length; and by the *kidneys*, which are placed in the *lumbar region* (or that of the loins), one each side of the spine.

Such being the normal disposition of the organs of the trunk, we may now refer to certain cases of malposition which have from time to time attracted notice. In 1882, conversing in Paris with my late friend, Sir John Rose Cormack, M.D., regarding malpositions of organs, I found that in 1881 he had published details of a very curious case of such abnormality—the case being all the more interesting in that the malposition of organs was detected during life. The patient—one of Sir John Cormack's own—was a young lad, who presented such peculiarity of chest-structure that, after further examination—substantiated and verified by the independent opinion of other eminent physicians—he was declared to present complete transposition of his internal organs. In this patient, by aid of careful examination, the heart was ascertained to occupy a situation on the right side of the chest, corresponding to that in which it naturally lies on the left side. Furthermore, the liver instead of being situated on the right side of the abdomen, was ascertained to lie on the left side. The situation of the spleen was not determined, but the probability is that this organ was likewise altered in position. The patient himself was a robust, healthy, young man, an officer in the English army; athletic, and much given to gymnastic exercises.

Sir John Cormack, in the paper descriptive of the above case, quotes other instances of the same and of allied conditions. Professor Gruber, of St. Petersburg, gives the case of a young soldier, in whom, likewise, complete reversion of internal organs was found after death. The heart lay principally on the right side; the left lung showed all the characters of the right,

and *vice versâ;* the position of the "midriff" was reversed; the liver lay to the left side; the spleen lay behind the stomach on the right side; the pancreas was reversed in position; and *two additional spleens* were also found. Professor Gruber, analyzing seventy-nine cases of this curious tendency—one of these occurring in the horse—showed that the majority of the cases occurred in the male sex. By some authors it has been alleged that in left-handed subjects there is often such malposition of organs; but this latter opinion is not borne out by what has been actually observed and noted in the study of these cases.

In reply to an inquiry of mine respecting the influence of inheritance in determining or producing these transpositions of parts, I was referred by Sir John Cormack to a list of authorities, and my late friend's manuscript notes lie before me as I write. The general opinion appears to indicate that this condition, as far as is known, is not materially influenced by inheritance. Perhaps the most interesting fact which our search into the causes of these conditions revealed, was a remark of Dareste's, who asserts that he produced a transposition of organs in a chick by exposing one side of a hen's egg to a greater heat as compared with the other side. One side was exposed to a temperature of 41° to 42° C., and in the young bird the organs were found to be transposed. But it is evident much further research is required before this experiment can be accepted as in any way explanatory of the cause of the conditions observed in the young bird.

More recently (1883) a case of malposition of organs was recorded by Dr. W. J. Mickle, of Bow. Here, in the case of a man aged forty, the heart was found to be transposed; the liver lay to the left side; the lungs were reversed; the spleen lay to the right side; while the disposition of the intestine was found to follow the same order of reversion—the junction of the large and small intestine taking place on the left, instead of on the right, side.

More recently a case of such transposition of organs has been

extensively quoted in English journals from the *Philadelphia Record*, as an occurrence of great rarity. Headed "One of Nature's Freaks," the case in question has been much discussed by the public, the result of the journalistic heading having had the effect of elevating a well-known physiological occurrence into the rank of an event of unprecedented kind. In the instance to which we allude, a medical man discovered that the patient's heart lay over to the right side of the chest, while the other organs are tacitly to be taken—as the description goes—as having their positions reversed.

A remark contained in the paragraph, to the effect that the medical attendant, who discovered the unusual situation of the heart and other organs, pronounced the condition one of extreme rarity, seems to show that the literature of the subject is not so well appreciated on the other side of the Atlantic as in Europe. Be that as it may, these cases reveal an aspect of living beings which is not without its instructive side. The lesson of life's adaptation to unusual conditions is again taught us by a new channel. We see the possibility of life's processes being carried on, even though the heart itself—not to mention other organs—is, anatomically, not "in its right place."

SLEEP-WALKING AND RELATED CONDITIONS OF MIND.

I.

The "sleep-walker" has always formed a subject of interest to the curious-minded among the lay public and to the man of science alike. It might be added that there are few, if any, conditions of our mental life, which in, one phase or another, are destitute of interest when regarded from the attitude of that

science which seeks to explain their nature as far as in it lies. Even sleep itself is a condition which possesses its own attraction for the observer who delights to dwell on the ways and works of his own life. Dreams have formed an absorbing topic from all time past; and sleep-walking, "mesmerism," and related conditions, it is needless to add, possess an attraction of their own for layman and philosopher alike.

The topics to which we have just alluded, however, have too often been relegated to the domain of the charlatan and the conjurer, and have in some cases become invested with an air of mystery which is not that of the undiscovered in science, but that of the show-booth and the exhibition-room. For example, when the name "mesmerism" is mentioned, the title recalls to mind exhibitions at which persons may be seen apparently deprived of their wits and senses, and ready to obey the behests of the "operator," who, as often as not, is a mere showman, as ignorant of the phenomena with which he is dealing, as are the subjects themselves. Hence "mesmerism," as the name for a series of interesting mental phases, has acquired a kind of popular discredit, which seems at once to place the subject outside the bounds of the domain in which science reigns supreme. That this state of matters should not be allowed to continue, and that the public should be educated in all topics relating to the mental life of humanity, are eminently desirable aims. It is satisfactory to note that of late years increased attention has been paid to subjects which had been allowed to lapse into comparative neglect by men of science. The latest contribution to literature of this description is an eminently noteworthy one. It assumes the form of a most interesting volume, entitled "Sleep-walking and Hypnotism" (Messrs. J. and A. Churchill); the author, Dr. D. Hack Tuke, being well known no less as an investigator in fields of mental science, than as a skilful physician and a man of wide experience in the treatment of the insane. Dr Tuke's volume on "The Influence of Mind over Body" has become a classic

work in the department of mental science. Writers who from an established position in science can afford to treat an abstruse topic popularly and clearly, really lay the reading public under a heavy debt of obligation. In the present instance, when we shall attempt a survey of Dr. Tuke's conclusions regarding "sleep-walking" (or somnambulism) and allied states, we may discover that our indebtedness to the author is of very marked kind. In the work before us, he has given us a volume which is thoughtful, interesting, and—as far as our knowledge of the ways of the mind and workings of brain are concerned—of high importance as an educative work.

By "somnambulism" or "sleep-walking," as every one knows, is meant that state of mind and body in which, while the subject is apparently removed from the consciousness of the outer world ordinarily experienced in his waking life, he is able to perform many acts, ordinarily associated with that waking life alone. By "hypnotism," or "artificial somnambulism," as it is termed, on the other hand, is designated that mental condition commonly known as "mesmerism,"—a name, derived, it may be remarked, from Mesmer, the French operator who first brought the phenomena markedly into notice. The "mesmerized," or "hypnotized" subject, is really in a state of "sleep-walking" or somnambulism, which has been induced by an operator, just as, conversely, the true "sleep-walker" has fallen into his state irrespective of any outside or operative influence. The likeness between the two states, is so striking and complete, that it is now most natural they should be discussed in the light of related conditions of mind. The study of the one condition and its causes, besides, is well calculated to throw light on the nature of the allied state; and a clear gain to science thus appears, when, instead of the conditions being regarded and studied as separate states, their relationship is thus recognized.

Of the importance of the study of sleep-walking, Dr. Tuke says most truly, that considering the anxiety it causes, and

the peril it involves, and noting how often parents and schoolmasters seek counsel as to the best moral and medical treatment for its cure, it is surprising that so little attention has been bestowed on the subject. "One-third of our existence," says Dr. Tuke, "is passed in sleep, and it would be strange if this unconscious life, in which the will, but not necessarily the action, is suspended, were not one of serious importance, both medically and legally." He is again thoroughly scientific when he says, that it is desirable first to study the facts of a *natural* state like "sleep-walking" before one attempts the study of an induced or artificial state like "mesmerism." He makes a most effective point in decrying the superstitious notions which have become attached to the topics under notice, when he adds that "it is obvious that on the vexed question of animal magnetism, the bearing of natural somnambulism is most important, as the condition and acts of the sleep-walker cannot be attributed to a magnetic fluid passing from an operator to the subject."

In the endeavour to understand the phenomena of sleep-walking and mesmerism, it is necessary to bear in mind the primary fact that the brain is not one single nervous mass, but a collection of masses, each possessing its own function and discharging its own duties in the regulation of life. Roughly speaking, we can realize the physiological nature of sleep and dreaming, and of somnambulism itself, if we suppose what seems actually to take place under such circumstances—namely, that whilst certain "centres" of the brain are asleep, and therefore temporarily paralyzed and unfitted for duty, others are active and wakeful. It is this thought of the really many-sided work, duty, and nature of the brain which forms the foundation and basis of all the explanations which can be given of the curiosities of brain-action. Taking up this clue, we can understand the meaning of Dr. Tuke's phrase, "that the intense concentration of the attention on the all-absorbing dream which is being acted prevents the consciousness of all sensorial

(or outside) impressions, except those immediately in relation to it." Still, the sleep-walker must be regarded as a wonderful phenomenon among living beings when we regard the careful acts he performs, his intense wakefulness to some impressions, and his death-like indifference to others. Hippocrates said of sleep-walkers that he had "known many persons during sleep, moaning and calling out . . . . and others rising up, fleeing out of doors, and deprived of their reason until they awake, and afterwards becoming well and rational as before, although they may be pale and weak." Aristotle said that "Some are moved while they sleep, and perform many things which pertain to wakefulness, though not without a certain phantasm and a certain sense, for a dream is, after a certain manner, a sensible perception."

From the quiet, dreamless sleep, which is nearest in respect of the absence of apparent mental action to death itself, through the stage of dreaming, onwards to muttering and talking in the sleep, and thence to the acts of sleep-walking, there exists a series of graduated stages, teaching us, in truth that somnambulism is, after all, not a solitary condition of brain, but one connected with common-place and facts of ordinary existence. "It is not extraordinary," says Dr. Tuke, "that dreaming should sometimes be sufficiently vivid to excite movements." On the contrary, it is not merely a natural, but a scientific expectation, that the activity of brain, which begins with a dream, may, under favourable conditions, pass into, and become, the exciting cause of sleep-walking itself.

In his efforts to obtain reliable information regarding sleep-walking, Dr. Tuke prepared and distributed a circular, in which persons were invited to detail the circumstances of their habits in this respect. His analysis of certain of the cases of which particulars were thus gained is extremely interesting. Thus it is in childhood and at puberty that sleep-walking is most commonly seen. Dr. Tuke's youngest case was six years old; his oldest subject was sixty-one. It is unusual for the habit to

appear after twenty. Sleep-walking was common in one correspondent after an evening of absorbing work, and after days of "excited sight-seeing." In another case, suppers did not induce the habit, while too close study favoured somnambulism. The state of the health affected some, but did not affect others. The particular occupation of the subject affected the act of somnambulism. A school-girl, overworking herself at Euclid, gets up in the night, and looks for her books. A boy of eight, fond of his rocking-horse, rises at night, rides the horse, and is awoke by the motion.

II.

Dr. Tuke gives additional examples of the "sleep-walking" state; and amongst these examples are several cases of a highly interesting kind. A lady, on retiring to rest for the night, takes, in good humour, a magazine with her, which she knew her brother is most anxious to read. She reads the volume for some time before going to sleep. In the course of the night, she rises in a somnambulistic state from her bed, passes into her brother's room, and lays the magazine on his bed. In the morning, she has no recollection whatever of having performed this act. Here, no doubt, the dominant idea which operated in the mind of the sleeper was that of her brother's desire to possess the magazine. When the intellectual and conscious centres of the brain were lulled to sleep, other centres coming into play and stimulated by the idea in question, aroused the muscles to action, and carried out the intent which was thus unconsciously formulated in the brain.

Instances of sleep-walking, conducted often under circumstances of extraordinary kind, are well known to all students of mental science. Galen, of old, fell asleep whilst he walked, and was only awoke by knocking his foot against a stone. Felix Plater fell asleep whilst playing the lute, and continued

until the instrument fell from his hand. A friend of Plater fell asleep while reading a book aloud, and continued to read an entire page while asleep. We shall notice later on cases allied to this last, in which an apparent power of appreciating written characters has been illustrated in the somnambulistic state. Soldiers on the march have been known, when thoroughly exhausted by fatigue, to fall asleep and to continue the march. In the retreat from Moscow, this feature was seen in the French ranks.

Occasionally, feats involving considerable exercise of muscular and directive brain-power may be performed by sleep-walkers. A case is related in which a young man, falling asleep in the pump-house of a mine in which he worked, walked to the door, passed to the engine-shaft, descended twenty fathoms, and was found resting with his back on the ladder at that depth. He had no recollection of descending; but the fact that such descent was part of his daily duty, and had therefore come to be automatically performed, as it were, serves to account for the ease with which it was undertaken in his sleep-vigil. The same remark holds good of the case related by Macnish, in which a sleeper walked along a particularly dangerous path for two miles, and plunged into water, having swam a mile and a half before he was discovered and roused. A Highland boy, accustomed to swim a river daily in the exercise of his work—that of herding cows on the opposite bank—was seen to rise in his sleep, and to repeat his daily duty. But for the fact that he was accustomed to contact with the water, there can be little doubt that the shock and cold involved in his plunge would have aroused him from his slumber. Martinet has given a case in which a watchmaker's assistant had an attack of somnambulism once a fortnight. In his sleep he was then accustomed to rise from bed and to do his work with the same accuracy as when awake. Macnish relates that a boy "dreamed" that he got out of bed, ascended to the top of a high rock, found an eagle's nest, and brought it back, placing the nest under his

bed. The events he imagined as having constituted merely a dream, actually took place; the nest was found under his bed as described by the boy, while the precipice he had to scale was noted as one of the most dangerous and inaccessible in the district.

Dr. Tuke, addressing himself to the question of the sight of the sleep-walker, found in the answers which were returned in reply to his circular, that only in one case were the eyes reported as being shut. The sleep-walker, as a rule, appears to have the eyes open and vacant. It is interesting, also, to note that a correspondent writes to Dr. Tuke that "while certainly some of the objects appear (to the sleep-walker) as they really are, others are adapted to the dream. For example, the bed-posts appear to be trees." "There are cases," says Dr. Tuke, "in which the power of seeing in the dark is very striking." The sight is often acute, and the dilated pupil of the eye found in this state "permits the sleep-walker to see objects with an amount of light which is practically darkness under normal conditions. In avoiding furniture, he is greatly assisted by acuteness of touch when it is in immediate relation to the idea upon which all his nervous energy is concentrated."

In this latter remark lies the explanation of much that appears wonderful and mysterious in a sleep-walker's acts. If we suppose the mental powers in ordinary waking existence to be concentrated and fixed upon a given object, to the exclusion of all others; or if we imagine one sense, say that of sight or hearing, to be strained to the utmost while the other senses are neglected meanwhile, we know that in such a case results of remarkable kind are attained. If the whole attention be concentrated on one sense or series of impressions, these particular impressions, for the moment, are received and perceived in a fashion so complete as to outrival the sensations experienced in the ordinary working of the senses. The case of the blind offers a parallel instance to this exaltation of sense which is seen in the sleep-walker. The acuteness of hearing in the blind is often

remarkable; and we see here an increased sensitiveness of the hearing powers, due to concentration in that direction, following upon the deprivation of sight. Thus, the sleep-walker, according to the nature of his dream or action, has sight, hearing, or touch, as the case may be, exalted at the expense of other faculties. He may balance himself in safety on giddy heights, on house roofs, on precipices, and so forth, because his whole attention is concentrated on the performance of such a feat. He has acquired, temporarily, the dexterity which can only come in waking life by long training and experience, and he passes safely through ordeals of the most trying kind, because his nervous system has concentrated all its available strength in one special direction.

A second point of importance in the consideration of the sleep-walker's acts, is involved in this apparently puzzling activity of the senses unaccompanied by any consciousness of what is seen or heard as in waking life. We are so much accustomed in our waking existence to speak of and to think of seeing, hearing, touch, &c., as acts discharged in the full consciousness and knowledge of self and self's ways, that it is at first difficult to divest the mind of the notion that seeing, hearing, and other senses may be exercised unconsciously, and may be actively engaged, apart from all knowledge or appreciation of their work. Thus a person deeply engaged in the study of a thrilling novel, absorbed in the contemplation of a play, or abstracted in a day-dream or reverie, may be spoken to without evoking any response. In such a case the waves of sound affect the ear, as when the attention is fully bent on hearing what is said. There is no closing either ear or eye to sound waves or light waves. It is also probable that the hearing centres of the brain in the case of the person spoken to whilst absorbed in book or day-dream, are fully awake to the reception of sounds. What is wanting, therefore, is really the higher and truly intellectual power which receives, appreciates, and deals with the messages the senses convey. The sleep-walker is largely

in the condition of a person in the day-dream or who is absorbed in a book. If we can suppose that the intellectual powers are abolished or held in abeyance for the time being, and that concentration of one or more of the senses takes place and is controlled by the non-intellectual parts or centres of the brain, we may readily see how and why the sleep-walker is able to pursue his marvellous way through the land of dreams, and to guide his steps through the actual world with an accuracy he fails to exhibit in his waking hours.

Different individuals exhibit varying degrees of completeness of sense under the sleep-walking vigil. There is a case on record, related by Dr. Pritchard, in which one Negretti, a servant, who had been accustomed to walk in his sleep from his eleventh year, repeated in his sleep the duties of the day. He carried glasses and trays, and laid the table for dinner, his eyes being firmly closed. He frequently struck against doors and other objects; and when a bottle was substituted for the candle he carried, the bottle was held and treated as if it were a candle. He took coffee for snuff, and drank water for wine. Here the case would seem to differ in few particulars from one of the mesmeric state. It certainly shows a resemblance to that state rather than to sleep-walking pure and simple; but the two conditions, as we shall see later on, are closely related.

Dr. Tuke says, "It is true that a somnambulist may write well, although a sheet of pasteboard is interposed between his eyes and the writing paper. If he has not crossed a *t* or dotted an *i*, and is requested to supply the omission, he may do so with great precision. But if the paper be shifted, his corrections are no longer in their right places on the paper, but wrong to the extent to which the paper has been moved." In one case, a lady wrote letters with great accuracy in a room so dark that her physician could not distinguish the objects in it. "That she depended, however, upon her sight, was shown by the fact that when an opaque body was placed between her eyes and the paper, she stopped writing and was much disturbed." Here

the case of the typical somnambulist, depending on an exaltation of sense for the accomplishment of her movements, was probably illustrated.

In certain cases in which Dr. Tuke had the opportunity of interrogating the subjects of sleep-walking, the sense of hearing was said to be good; only one of his correspondents wrote that he "did not hear when spoken to." One could hear when in the somnambulistic state, but could not see. As regards *smell*, in several cases this sense appeared to be deficient in the sleep-vigil. One subject dreamed of smells; he fancied there was an escape of gas; rose, and looked all over the bed-room for the gas-pipe, no gas being laid on in the house in which he lived.

III.

The features of interest which present themselves for notice in the sleep-walking state, include the question of activity of other senses in addition to those just considered. We saw that sleep-walkers may exhibit marked differences in respect of the activity of certain senses over others, and that the degree of wakefulness of the senses also varies in different subjects. Thus, for instance, it would seem as if in certain cases hearing may be present; in other sleep-walkers, this faculty is, for the time being, in abeyance. Touch, and what may be called the "muscular sense," are, as a rule, very actively exercised in the case of the sleep-walker; and we have seen that it is the extraordinary dominance which this latter sense may assume, that accounts for the ability of the sleep-walker to traverse giddy heights, to scale precipices, and to walk safely on house-roofs—feats which, in his ordinary waking life, he would never dream of attempting to execute. In waking life, the nerve-power, so to speak, is distributed over various senses and acts. In the sleep-walker, this power is concentrated on the fulfilment of one special act. Hence his

ability to exist safely under circumstances of peril and danger, such as have been already detailed.

Respecting taste, Dr. Tuke, in his interesting volume, says that no reference to taste was given in any of the replies he received from somnambulists. But he refers us to a case of induced and spontaneous sleep-walking which occurred in Guy's Hospital in the person of a servant-girl sixteen years of age, and in which the sense of taste was deficient—at least, in so far as mistaking one substance for another was concerned. Thus tea was given for coffee, and was swallowed under the delusion that it was the latter beverage. Bread and butter, which were at first given to this patient as such, were afterwards greedily eaten for cake, on the patient being told that it represented the latter substance.

The sense of *touch* would appear, as a rule, to be acute in sleep-walkers. One of Dr. Tuke's correspondents often dreamt he was touched, with the result of the thought awakening him. Some sleep-walkers, however, may not only be touched, "but," adds Dr. Tuke, "may be carried back to bed without being aroused from their sleep." Allied to the question of touch, is that of insensibility to pain. When absorbed in acting out their dream they are non-sensitive to pain; but it is probable that varying degrees of this insensibility to pain exist.

The *range of movements* executed by the somnambulist, and the complexity of the actions he may execute, vary, as do the other phases of his condition. Dr. Tuke relates several highly interesting examples of such complexity of acts in sleep-walkers. A medical man, well known to him, when young, "would get out of bed, go to a cupboard, and select one of his toys, and present it deliberately to his family." In another case, a young gentleman "will take elaborate pains to undo the fastenings of a window, and would precipitate himself, if not prevented either by awaking in consequence of the effort, or the cold air, or by being forcibly held back. A common act of his is to go down stairs, open the front door, and look into the garden, then

return, and, after locking the door, get into bed. 'As far as I can make out,' he says, 'all my movements in sleep are as active as when I am awake.'" A boy, in his sleep, used to try to discover his father's razors; when found, he took them out of their case, and placed them in another situation. This case was cured by simply removing the razors, the boy returning to bed when he could not find them, and ceasing his somnambulistic practices. A boy, in his sleep, opened his bedroom window, got out, and fell to the ground below. He was lame for some months in consequence of the injury he sustained—his room was situated on the third floor—but suffered no other injury.

Accidents of a more serious character have happened to sleep-walkers, and on more than one occasion there can be little doubt the crime of murder has been committed by somnambulists, who, mistaking their bedfellows or companions for the objects of their dream-hate, have inflicted fatal injuries on their sleeping neighbours. Dr. Tuke tells us of a case in which a boy was found one night furiously shaking his bed-post, under the idea that he had got hold of Legree, the villain in "Uncle Tom's Cabin," while later on, when a student, he was startled to find the fire-irons in bed beside him. The latter incident was explained by his dream that robbers were about to break into his house, and that he intended to confront them with the poker. "Substitute," says Dr. Tuke, "for the bedpost, a child in the bed or room, and clearly this might easily have become a criminal case." Another case is given in which a girl aged twelve, walking in her sleep, violently assaulted, when in that condition, a schoolfellow with whom she had had a quarrel on the previous day. The assaulted girl cried out, and when assistance arrived, the culprit was found to be in a state of somnambulism. It becomes abundantly clear that this curious condition of mind is one in which responsibility for acts of violence which may be committed therein is as completely unrepresented as in the case of the deranged and raving lunatic himself.

The acts of sleep-walkers present striking contrasts and peculiarities in respect of the objects of their quests and activity during the somnambulistic state. A girl, whose family had become reduced in circumstances, had been duly impressed by her mother with the idea that she must work hard at school, and profit as much as possible by instruction, the expense of which could so ill be afforded. The mother's words evidently impressed the girl very deeply. The lessons were learned in bed in the morning, but while her sisters were diligently engaged in conning over their tasks, the girl above-named found to her surprise that she knew the lessons perfectly. Morning after morning, the same state of perfect but unknown preparation occurred; the apparent mental feat causing much thought to the parent. On one occasion, when the mother had been paying a visit, and returned home at a somewhat late hour, she was surprised to find the girl in question seated in her nightdress at the window of her bedroom, in the bright moonlight, and in a state of sound sleep. Her lesson-book was in her hand, and it was evident that, under the influence of the strong desire to make the most of her education, the girl had been roused from the quiet sleep of natural life to the activity of somnambulism.

In another case, a teacher gave a class of boys the proof of the 47th problem of Euclid's first book as an exercise. One alone succeeded in effecting the proof. "For some time," says Dr. Tuke, "he was baffled with one stage of the proof, and retired to bed with his mind full of difficulty." Late that night the teacher, in going round the bedrooms before retiring to rest, found this boy kneeling in his bed, with his face to the wall, and pointing from spot to spot, as if following a proof in a figure on a black board. He was so absorbed in his occupation that he neither noticed the light of the candle nor answered when addressed by name; in short, he was asleep. He was not disturbed, but was left still proving his problem. Next morning, before he left his bedroom, the teacher said to him: "Well, John, have you finished your proof?" His reply was, "Yes, I

have. I dreamed it, and remembered my dream this morning, and got out of bed as soon as I could see, and wrote it out at the window."

Drs. Pritchard and Macnish quote a case which deserves mention here on account of the apparent completeness of the acts performed by the subject of the recital. The patient was a girl of sixteen. She exhibited a strong tendency to fall asleep early in the evening, and talked much in her slumbers. Her speech was of a coherent and rational description; and, while in this state, she repeated the occurrences of the day, and sang various airs. Later on she answered questions while in this state. She dressed the children while "dead asleep," as her mistress termed her state; and while in this condition could lay the table for breakfast. She was taken to church, and was apparently impressed by the sermon, but afterwards denied having been to church at all; although in a subsequent attack of somnambulism she repeated the text and substance of the sermon. Being ill-treated by a fellow-servant while in this state, the girl remembered nothing of the incident when she awoke, but, when in the somnambulistic state, subsequently described the occurrence to her mother.

The cases just alluded to, but more especially the latter instance, show very clearly the essentially machine-like (or *automatic*) nature of the lower brain-centres which rule the acts of the sleep-walker. When awake the girl remembers nothing of her visit to church; the intellectual centres had no concern with the visit or with the remembrance of the sermon. But when she falls asleep once again, these lower centres, resuming control, take up the thread of the story, much as a clock which has been stopped at a given moment automatically passes in its succeeding beats to the figures which come next in order.

IV.

In connection with the elucidation of the ways and works of sleep-walkers, the well-known case of the French sergeant, related by M. Mesnet, becomes extremely interesting. Here we find actions following injury of the brain to mimic, in an extremely close fashion, the ways of the somnambulist. We may see, plainly enough, that what may occur naturally enough in certain individuals as the result of brain-excitement of one kind or another, may be reproduced before us under the guise of a diseased, or of an artificial, condition of the organ of mind.

The soldier just alluded to was injured in the left side of the head by a musket-ball at Sedan. Immediately thereafter, his right side being paralyzed, he became senseless. Three weeks after he awoke to consciousness in the hospital at Mayence. For a year the paralysis of the right side continued, but his condition improved under treatment. Curious periodical aberrations of the intellect, however, began to appear about three months after his mishap. These latter symptoms occurred at intervals, varying from fifteen to thirty days, and they lasted from fifteen to thirty hours. His abnormal periods were therefore short as compared with his normal ones. The peculiarities of his abnormal period was very marked. His eyes were wide open; his movements were regular but automatic; he went wherever he was directed; when he stumbled over an object he felt about for the obstruction and then passed on one side; and he ate and drank as usual, and rose and retired to rest at his accustomed hours. More curious was the fact that pins might be run into his body without eliciting the slightest exclamation of pain. To electricity he was equally insensible; he heard not, but rarely saw, and did not distinguish what he ate or drank. His sense of touch alone was present, and that in an elevated degree; but, curiously enough, when placed in an appropriate position, he might be made automatically to

express in pantomime the movements of reconnoitring or skirmishing in an enemy's country. He could hum a tune, and sang from a roll of paper placed in his hand as if it were a vocal score ; and as refreshment, swallowed between his songs, without grimace, a mixture of strong vinegar and water. That the sense of sight, although deficient, yet played a part in directing the abnormal life of F., was apparent in an experiment of Dr. Mesnet's, in which, when engaged in writing a letter, a screen was interposed between his eyes and his letter. The sergeant proceeded for a little time with his letter, finally, however, coming to a halt as his words became illegible, but without exhibiting a sign of annoyance. When sheet after sheet of a superimposed series was withdrawn as he wrote, so that each sheet contained but a few words of his letter, he continued to write on, signing his name on the last sheet as if it contained the whole of his communication, and correcting the imaginary writing which he supposed was represented before him. His tobacco-pouch being removed after the manufacture of a first cigarette, he neither saw nor smelt the missing object, but when it was placed in his hand the automatism of his nature asserted itself, and another cigarette was duly manufactured.

The sergeant was also noticed to come in contact with a table, to pass his hands rapidly over it, and then, finding nothing, to open the drawer of the table, with the result of discovering a pen therein. The touch of the pen apparently awoke the idea of writing. In the drawer he found paper and an inkstand, which were duly placed on the table. Taking a chair, he sat down and began to write a letter to his commanding officer, suggesting that he should receive a medal for the bravery he had displayed in battle. The letter was written in an incoherent and confused fashion; but, adds the account, not more so than the letters he was accustomed to write in his lucid intervals. Then succeeded the experiment of interposing a screen in front of his eyes, as above detailed. While engaged in writing, water was substituted for ink. He wrote on

so long as the pen made markings on the paper, but ceased when it failed to make characters. He then wiped the pen, rubbed it on his coat, and began again. The same result accruing, he made another, and, of course, unsuccessful attempt to adjust his writing materials, but the ink-pot itself seemed entirely to escape his scrutiny. That sight was employed in the sergeant's acts of writing was an obvious fact; but, adds Dr. Tuke, it was as certainly not employed, "except in regard to the particular subject upon which his attention was absorbed, and with which he was brought into relation by the sense of touch." As in the sleep-walker, that sense appeared to receive a singular power and elevation, and to supplant for the time being all other modes of communication with the outer world.

With reference to that part of the experiment in which the sheets of paper were successively removed, it should be added that the sergeant had taken ten sheets, and had written words on the first sheet when Dr. Mesnet removed it. The patient continue to write on the second sheet, as if the first had not been removed, and when the second sheet was removed, after he had written ten words thereon, he finished, on the third sheet, the line of writing he had commenced on the second. The third and fourth sheets having also been removed, the sergeant signed his name on the fifth sheet—which was practically blank—at the bottom of the page.

Now were observed an interesting series of facts. The sergeant was then noticed to look at the top of this fifth (and blank) sheet, and to re-read in his mind, of course, all he had written. His lips moved at each word; he punctuated his writing, and placed commas; spelling his words, and amending them by inserting *e*'s and *t*'s. Each correction corresponded exactly to the word requiring emendation, and to the spot on the special sheet of the series in which he had written it. It is evident that here again we are merely dealing with a form of brain-action allied in the closest possible manner to that of the sleep-walker who, rising from his bed, writes a learned legal

opinion in one case, or solves a problem in Euclid in another. What occurred in the unfortunate sergeant as the result of brain-injury is witnessed likewise in the subject of the "acted dream." In both it seems evident that "the image of the writing," as Dr. Tuke puts it, "remained registered, so to speak, in the brain"; or, as Mr. Galton would say, "the writing was visualized," and appeared clear and defined to the "mind's eye," in the brain, which, after all, is the true seat of the sense.

Before passing to consider the subject of mesmerism, we may glance, by way of close to the present article, at certain facts regarding sleep-walking which may serve to complete our consideration of that special topic. That dreaming plays an important part in arousing the activity of the somnambulist admits of no question. It is the dream (i.e. activity of brain) which sets the body in action. "One girl," says Dr. Tuke, "always dreamt that the room was full of boiling water, and that she was trying to escape from it." "A lady," he continues, "informs me that an act performed by her daughter during sleep was connected with a dream in this wise: She dreamt about a shipwreck, and she awoke finding herself out of bed. In the morning she found she had wrapped a large shawl carefully round the candlestick which was in the chair by her bedside. She thus clearly saw that the explanation of the act lay in her having succoured a shipwrecked sailor, for whom the candlestick had done duty."

As regards *recollection of the acts performed by sleep-walkers*, certain patients remember nothing whatever regarding their sleeping state, while others may partially or even completely recollect their acts. "More commonly," says Dr. Tuke, "if any remembrance survive, the dream is remembered and the motor action is not." He adds, that "the fact that the memory is, in many cases, entirely absent, is one of the most interesting phenomena of somnambulism." What we have to bear in mind is, that in these acts of the brain, in which the lower centres are involved, no consciousness is involved. The Ego—the

active, knowing personality of the individual—is really asleep and in abeyance. It is the machine-like parts of the brain, the servants of the intellectual centres, which, taking upon themselves the functions of these higher centres, rouse the muscles into activity, and convert the man, for the time being, into what is practically a human automaton or machine.

V.

Passing now to consider the state to which the name of *Mesmerism* has been given, we discover that in many interesting points this state resembles that of the sleep-walker. To the series of nervous acts collectively named "Mesmerism"—a term derived from Mesmer, the French quack, who was among the first to employ the condition in the attempted cure of disease—the terms *hypnotism* and *artificial somnambulism* have also been applied. Dr. Tuke fully recognizes the high importance of our being able to form some conception of the mental state of the "mesmerized" or "hypnotized" subject, in order that we may thereby be enabled to know something of the nature of related actions of the brain. There exists the greater need that such an inquiry should be undertaken, from the fact that the phenomena of mesmerism have long formed part of the stock-in-trade of conjurors and others, and have, in this association, been frequently relegated to the domain of the quack, while their true nature has, of course, been much misunderstood. In proof of these assertions one may only point to the common and conflicting statements that "there is nothing in mesmerism," and that "it is beyond all human power of explanation." Extremes meet here, as elsewhere; and in showing the condition of the mesmerized is simply one closely related to sleep-walking and other states of mind, the physiologist is not merely dispelling a lamentable ignorance of common nervous states, but is rescuing an interesting topic from the domain of the ignorant and prejudiced.

With the appearance and acts of the "mesmerized," few readers can be unfamiliar. Out, of say, a dozen subjects selected by the operator, a few succumb to the mystic "passes" through which the mesmeric condition is believed to be produced. These subjects then seem to lose all idea of their own personality and identity, and give themselves up to the various suggestions of the operator. One without any power of song, is told he is Sims Reeves, and thereon proceeds to warble forth what he imagines is a beautiful tenor solo. Another drinks castor-oil on being told it is port wine or champagne. A third imagines, at the behest of the operator, that he is addressing the House of Commons, and a fourth may be made to remain immovable and fixed at the will of the operator. With such an exhibition most of us are well acquainted. Often termed "electro-biology"—a high-sounding title for which there is not the slightest justification—the condition of "mesmerism" is believed to be associated with some wondrous and occult power possessed by the operator. Hence, as in many other cases of popular inquiry into scientific subjects, the whole topic is supposed by the public to be vastly beyond the reach of explanation. Such an opinion evidently, however, fails to take into account that, even were this latter assertion correct, the operator of the entertainment halls must, at least, know less of the nature of the conditions he produces than the man of science who makes the nervous system and its operation a special study. While it is too frequently forgotton that, so far from being ignorant of the nature of "mesmerism," we in reality can now approach tolerably near to its explanation. In this as in other matters of science, much light is thrown upon special fields of inquiry by the researches undertaken in other departments.

The day-dream or reverie, as the most familiar form of what is generally named *abstraction*, leads us to the confines of mesmerism. "Absent-mindedness" is thus the initial stage of a condition which carries us very close to the borders of the mesmeric state. Many persons absorbed in a train of

thought do not hear when they are spoken to, and are practically shut out, for the time being, from all participation in the affairs of the outer world. If we can further imagine two points, or phases of mind, we shall succeed in forming an idea of the manner in which the mesmerist produces the state which bears that name. Thus, firstly, if we suppose that the fit of abstraction from the active affairs of this world is produced artificially, by any cause (as by staring long and fixedly at an object, or by closing the eyes amid perfect stillness of our surroundings), we may gain an idea of the beginning of the mesmeric state. Secondly, if we can imagine that the fit of abstraction so produced deepens, and becomes much more intense in its nature than is seen in ordinary circumstances,—*so deep, indeed, that, as in sleep-walking, the intellectual parts of the brain remain in abeyance, while the lower centres continue in activity,* we can readily enough conceive how the mesmerized state deepens into and follows that of simple abstraction. It is on this latter account that "mesmerism" has been called "artificial somnambulism,"—that is, induced sleep-walking, as distinguished from that state when produced naturally. And, if we substitute for the natural ideas of the sleep-walker those which are impressed upon the lower centres of the brain by the mesmerist, we find a perfect parallel in a general way between somnambulism and mesmerism itself.

There is a point of some importance in connection with the study of mesmerism, and one which I am convinced has not always been so prominently noticed as it deserves—namely, the fact that only certain individuals are susceptible of being "mesmerized." As a general rule, it is the impressionable and excitable who are found to be the subjects of the mesmerizer's art. Every operator knows this fact, and acts upon it. In the entertainments to which allusion has been made, the operator invariably demands or contrives that he shall have as many of his audience on the platform as he can induce to offer themselves for experiment. He knows by experience that out of, say, a

dozen persons, only some three or four, on an average, will succumb to his "will." There is always a number of those who offer themselves dismissed from the platform as unsuitable subjects. These are matter-of-fact persons, not given to day-dreaming; persons who like to know the "reasons of things," and who, from the robust character of their mental state, are not in the least likely to drop their personality—or, in plain language, "to lose their heads"—at the behest of any operator. It appears thus to be a plain inference that some persons are far more susceptible to the sway of the "mesmeric" art than others. Other things being equal, it will be found that it is the impressionable minds which most easily succumb.

Of old, Mesmer induced the mesmeric state by simply making his patients look fixedly at a bright crystal, to which, of course, magical powers were attributed. I have seen a person pass into this state through being asked to gaze at a button on the operator's coat. Dr. Tuke remarks "that other methods are effective, as the monotonous sensory impressions produced by passes—the common practice of operators,—by counting up to several hundred figures, by listening to the ticking of a watch, &c." His assertion that "in a milder form we do the same sort of thing constantly in trying to go to sleep," is an observation of importance; while his words that he is "often surprised that persons do not sometimes throw themselves into an actually hypnotic condition in attempting to go to sleep," are also worthy of remembrance. They show that, after all, there is a borderland common to natural sleep, to sleep-walking, and to mesmerism. What we further require for the full understanding of the latter condition is the knowledge of the difference of brain-action, which leads from sleep and dreams to that of the mesmerized state.

Dr. Tuke tells us that the principle illustrated in all modes of producing the mesmeric state is " on the physical side" of things, the stimulation of some nerve of sense—that of sight or hearing, for example—which lies in close relation to the brain.

The constant "irritation" of such a nerve tends to exhaust and weary some part of the brain, and thus induces, we may reasonably suppose, dulness of the ordinary work of that part. The parallelism is seen to be very close here between sleep, as the restorer of wearied brain power, and the mesmeric state resulting from the exhaustion just described. The mental side of mesmerism is "the rivetting the attention on one idea." "Looking at an object," continues Dr. Tuke, "is not essential, for the blind man may be hypnotized, and in susceptible persons the merely expecting to be hypnotized is sufficient to induce it, the expectation in this case involving the concentration of the attention on one point." The analogy between such a condition of mind, in which, say, through being told that he will become mesmerized at a given hour, a person actually exhibits that state, and the "faith cures," which are likewise the result of ardent expectation, is too close to be overlooked.

VI.

With the first attempts to place the facts of "mesmerism"—or, as it was erroneously designated, "electro-biology"—on a sound scientific basis, the name of Mr. Braid, a Manchester surgeon, must ever be worthily associated. He was one of the first among scientists to rescue the details of "hypnotism"—another term for the mesmeric state—from the grasp of quacks and conjurers, and to evolve from the facts presented by the mesmerized those details which sufficed to present the condition in question in a scientific guise. Mr. Braid proceeded in his investigations from the point indicated in our last article on the basis of all researches into the nature of mesmeric acts—namely, the state of abstraction, of the reverie, or day-dream, as an initial condition from which sleep and the mesmeric state alike proceed. He early discovered that this state could be induced in certain persons much more readily than in others; and that by simply fixing the attention on an object for a few minutes, or even seconds, the subject could be made to pass

into the condition already described, in which any feeling suggested by the operator could be imitated or produced.

It may be interesting, as a record of the progress (and extinction by science) of quackery, to note that the name "electro-biology" first appeared about 1850 in the programme of two American adventurers. These persons asserted that by some occult and secret influence or power—to the nature of which, of course, it was asserted that they alone possessed the clue—issuing from a disc of copper and zinc held in the hand of the subject, marvellous results in the way of mental actions could be effected. Thus they claimed for their "electro-biology," as exhibited by the zinc and copper disc, that they could paralyze muscles, subdue the strongest will, cause the senses to falsify the patient's ideas, make the subject of their experiments obey every command, however arduous and extravagant, and influence his thoughts in any and every particular of life. The new "science" soon attracted a crowd of admirers. As usual, testimonials from persons who had experienced the effects of the "electro-biological" force poured in, and the world of thought appeared, indeed, to be in some danger of being completely revolutionized by the new discoveries in brain and nerve action.

Mr. Braid's scientific accuracy and powers of investigation, however, were soon exerted upon the marvels of the American firm. He saw that the results of the so-called "electro-biology" were simply those of mesmerism or hypnotism. The zinc and copper discs he proved to have not the slightest action or effect in inducing the state described. They were the mere addenda of the quack after all; and that they exerted no influence whatever was proved by Mr. Braid, who, substituting pieces of wood and other objects for the discs, found that all the marvellous powers claimed for the latter appliances were exerted equally by other objects. Indeed, as already noted, the mesmeric state was shown to be induced in many cases by simply making the subject look fixedly at a button on the operator's

coat. The exposure of these conditions thus afforded by Mr. Braid was beneficial in the highest degree, and served to educate the public in the true nature of the alleged marvels of the American entertainers.

Dr. Tuke, whose work has afforded material for suggestive thought on the subject of mesmerism and sleep-walking, gives some interesting particulars of cases of induced mesmerism which occurred under his own observation. Thus, Dr. Tuke remarks that "the voluntary surrender of the will—the subject placing himself passively in the hands of the operator—is also an important factor in nearly all the processes. It is the initial step to the subsequent surrender of the will of the subject to that of another; but the concurrence of the will is not absolutely necessary in those who have been already hypnotized, and are highly susceptible to sensory impressions, especially if these are associated in their minds with the hypnotic sleep." This latter remark is a highly important one. We see how powerful is the condition of previously induced mesmeric conditions in rendering a patient or subject readily susceptible to the influence of an operator. When a person has come to associate in his mind any impression—as, for example, the sight of a bright object—with the mesmeric state, the memory or suggestion of that object usually at once acts in inducing the state in question.

Professor Charcot, of Paris, remarks that a person liable to be mesmerized may sometimes be surprised and rendered unconscious "the moment his attention is in the least arrested. He is seized and, as it were, instantaneously petrified, whatever efforts he makes to resist the influence." Thus, in one of Richer's experiments, the flash of electric light on the face of persons not expecting it, or the sudden clang of a gong, will induce the mesmeric state. Richer gives an amusing instance —quoted by Dr. Tuke—of the effect which sudden impressions may have upon persons easily affected by the influences which produce the mesmeric condition. A patient in the Salpêtrière Hospital, at Paris, was suspected of stealing photographs

from the hospital, a charge which, however, she indignantly denied. One morning, M. Richer, who had been experimenting upon some patients, discovered the suspected person with her hand in the drawer which contained the photographs, while some of the views had already been transferred to her pocket. When M. Richer approached her, she remained still and quiet. She was apparently transformed into a living statue. The explanation of this curious event was easily found. The thief was a woman in whom the mesmeric state was easily produced. Experiments were being carried on in an adjoining ward, and the blow of the gong which had been used in the experiments had so affected the culprit in her act of theft, that it transformed her into a living statue, waiting the behest of the operator, with the evidences of her guilt in her hand. She was awoke by M. Richer simply blowing in her face. Her denials were no longer useless, and her mesmeric predisposition therefore served to detect her crime. Here, as in other aspects of life, we find the influence of habit powerfully exemplified.

In one of Dr. Tuke's cases, a bright metal tambour was placed between the toes of the subject, who gazed steadily at the object and described how, "from seeing the brightest point, he 'imagined' he saw successive bright rings, and that these gradually formed the lines of faces familiar to him, including those which belonged to people he had met at a supper-party a few nights before, one face, in particular, being that of an intimate friend. The latter form remained clearly defined in his mind until it gradually faded into a dim, cloudy haze, which was followed by semi-unconsciousness." In this state he replied incompletely to questions addressed to him for some time, and then became gradually rigid, in which condition the unconsciousness appeared to become deeper. He took no notice of what was said, although he probably formulated a dim consciousness of the meaning. In the rigid stage he developed severe muscular contractions, and from this state could only be roused by the cold douche, &c.

Such an account is very interesting, because it gives an idea of the feelings and sensations of the subject who is being "mesmerized." The same gentleman whose sensations are above described—a trained physiologist—says (in the notes to which Dr. Tuke had access) of another experience of the mesmeric state:—"I have not the smallest doubt that, at first, I succeeded in abstracting myself, as it were, from surrounding circumstances. I had been reading very hard for days past on the subject of intestinal digestion in relation to the bacteria (or living germs) produced, and I pictured to myself the interior of the intestine and its contents; then I tried to picture a special form of bacteria; and while I was engaged in contemplating its changes of form, I seemed to lose all consciousness of persons around me." The same gentleman, in another experience, succeeded in fixing his attention on six points of light reflected on his boots, and having a faint resemblance to the constellation Orion. "After looking fixedly at this for what seemed to me a long time, the idea of the constellation vanished, and its place was taken by the outline of the lower part of the face of a friend. All I could see was his beard and mouth, and part of his nose and one cheek; the rest was abruptly cut off by a broad, black area; the details were tolerably vivid."

It would appear from such accounts that the state of unconsciousness, in which the mesmerized person becomes utterly pliant in the hands of the operator, succeeds impressions of various kinds; probably differing widely in different individuals, and heralding that loss of ideas and of intellect which is characteristic of the mesmeric state.

VI.

We have seen that the mesmeric state could be induced by the mere suggestion of an idea or object, and that previous mesmeric states—or, in other words, the habit of being mesmerized—is one of the most powerful conditions in readily enabling a person to fall under the influence of an

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operator. Dr. Noble, of Manchester, gives a very excellent illustration of the rights and wrongs liable to be encountered in examining such a habit. A female servant had repeatedly been thrown into a sleep-walking (or mesmeric) state, the operator, so it was alleged, having acquired the power of producing this state *from another room.* The girl was situated in one apartment and the operator in another. Without her knowledge, he stated that he had paralyzed particular limbs by a fixed glance, unseen by the patient; while other curious conditions were brought about in the same fashion.

As a test or crucial experiment, the following course of action was decided upon: The operator wrote a note to Dr. Noble, as if on business, summoned the servant in question, and requested her to convey the note, and to wait for a reply. In her hearing he ordered a cab, saying that if any visitor called he would return at a particular hour. The operator, unknown to the servant, instead of proceeding to the place named, entered the cab, and drove to Dr. Noble's residence.

In ten minutes, thereafter, the servant arrived conveying the note, as she had been directed. She was shown into Dr. Noble's study, and was asked to be seated whilst a reply to the note was written. The chair on which she was seated was placed with its back to a door leading into an adjoining room, the door itself being left ajar. By previous arrangement it had been agreed, that the operator should approach the door in silence, and should endeavour, all unknown to his subject, to induce the mesmeric state. "There, then," proceeds the account, "was the patient or 'subject' placed within two feet of her magnetizer—a door only intervening, and that partially closed—but she, all the while, perfectly free from all idea of what was going on. We were careful to avoid any unnecessary conversation with the girl, or even to look towards her, lest we should raise some suspicion in her own mind. We wrote our letter (as if in answer) for nearly a quarter of an hour, once or twice only making an indifferent remark; and on leaving the

room for a light to seal the supposed letter, we beckoned the operator away. No effect whatever had been produced, although we had been told that two or three minutes were sufficient, even when mesmerizing from the drawing-room, through walls and apartments, into the kitchen. In our own experiment, the intervening distance had been very much less, and only one solid substance interposed, and that not completely; but here, we suspect, was the difference—*the 'subject' was unconscious of the magnetism* (so-called) *and expected nothing.*"

This case is thus highly instructive, because it shows us how much expectancy, or expectation of an event, has to do with inducing the given effect. It also proves in an extremely interesting fashion how much the mental idea, or the state of the mind, has to do with the production of the mesmeric state. The result of Dr. Noble's experiment is entirely in accord with Dr. Tuke's accounts of the mesmeric state. So long as the patients or subjects are carefully kept from any suspicion that the operator is influencing them or trying to induce the state in question, so long are they perfectly free from any evidence of such influence. But when the subject is warned that the experiment will be made, or even when suspicions that the operator is at work arise in the mind, the state is at once induced. As Dr. Carpenter pertinently remarks, "sensitive subjects have repeatedly gone to sleep *under the impression that they were being mesmerized from a distance*, when the supposed mesmerizer was not even thinking of them."

An amusing case illustrating this latter phase of the subject is given by Dr. Noble, above quoted. A young lady, highly susceptible to "mesmeric" influence was duly "magnetized" by the operator keeping his thumbs in opposition with those of the patient, and by gazing intently into her eyes. In a few minutes the mesmeric state was induced. When, after being awoke, she was again mesmerized by directing her to gaze at a fixed object, the result was the same. Personal influence seemed to count for little or nothing in the experiment. Being

again awakened, she was requested to rest quietly by the fire, to think of anything she pleased, and to look where she pleased excepting at the operator, who retreated behind her chair, saying he was about to try a new method, and that her turning round or observation would disturb the process. The operator thus feigning a new procedure, simply took up a book, and amused himself by reading the volume, directing no attention whatever to the subject. In a few minutes he saw, by the excited features of other members of the party, that the young lady was being once more mesmerized. Her actions, watched by other friends, were exactly the same as before; while she herself asserted that she felt the unseen passes of the operator streaming down the neck. Yet all the while the supposed operator had been resting quietly in his chair. In short, the subject became mesmerized simply because she thought she was being mesmerized, and the mental element is thus seen, once again, to be very strongly bound up indeed with the production of this curious state.

We see clearly enough that in mesmerism, as in sleep-walking itself, the chief point which has to be taken into account is the loss or paralysis of the will. As this point has already been stated in the course of these articles, the higher or intellectual parts of the brain are dormant, while lower centres respond to the various stimuli which are brought to bear upon them. Mr. J. N. Langley, who has recently been investigating this subject, succeeded in "mesmerizing" a frog and an alligator, while he repeated the well-known experiment on the fowl and pigeon. Thus a frog which is turned over on its back, and prevented from recovering its position, will, in a short time, become mesmerized. So, also, an alligator, after its struggles are repressed, becomes still and quiet, and may be kept in this condition by merely stroking the skin close to its eyes. Such experiments point to the widespread nature of the mesmeric phase in the animal creation, and they further divest the subject of any special importance, and of the exaggerated ideas attached to it as seen in man.

Summing up our consideration of sleep-walking, mesmerism, and allied states of mind, we may say, firstly, that these conditions affect the nervous system, chiefly on account of the intellectual centres of the brain being, for the time, rendered dormant and inactive, and because the will is practically abolished. In the second place, we have seen that certain types and phases of mind are more readily susceptible of mesmeric influence than others, and that the frequency with which mesmerism is produced, and with which sleep-walking occurs, is a powerful condition in easily determining these states. The causes, thirdly, which induce mesmerism, particularly, are nervous impulses conveyed by the nerves of sight, hearing, touch, &c., or ideas impressed on the mind—in the latter case, the changes or actions occur in the brain itself. Along with these considerations comes a fourth, which insists upon our recognizing that, when the brain and its centres are thus affected, they send out controlling influences over other parts of the nervous system and body, so that, as Mr. Langley puts it, the mesmerized man or animal gradually passes into a state of torpor, or of even complete insensibility.

We still require exact information regarding the mode in which these changes are brought about. For example, we know little or nothing respecting the manner in which the brain and its centres are impressed by the mesmeric "passes." What we do know, however, is that those "passes" are only pieces of jugglery after all, and that in the general study of the nervous system and its natural work are to be found the clues to the understanding of its less natural or even startling methods of action.

GOOD REMEDIES OUT OF FASHION.

I have borrowed the title of this article from that of a highly interesting pamphlet, by Dr. Hare. The pamphlet in question deals with topics of high importance alike to the public and to the medical profession. Dr. Hare delivered the substance of the *brochure* as an address to his medical brethren of the Metropolitan Counties Branch of the British Medical Association; and there can be no doubt that its republication will prove eminently serviceable to professional men, as well as interesting to that large and increasing section of the public who take an interest in the progress of the healing art.

Medical science, like most other mundane affairs, does not fail to reflect traces of progress and evolution. More decidedly, perhaps, than in any other section of human knowledge, is the gradual elaboration of opinion witnessed in medicine. The modes of treatment and the ideas and notions entertained regarding disease, represented even a quarter of a century ago, have in many cases been largely modified; in some instances, entirely superseded. This result is not by any means to be wondered at, but is, on the contrary, a clear consequence of the many influences at work, which drive medical science forwards and onwards with rapid strides. Medicine is really the sum total of the application of very many branches of scientific inquiry. From botany to the actual study of disease—from zoology, and chemistry, and physics, onwards to the knowledge of drugs and their action—there are varied and diverse sciences which culminate and focus themselves in the art which specially ministers to what Bacon calls "the relief of man's estate." Medical progress is, therefore, not merely sure —it is also in the truest sense rapid; and a glance at the researches and advances of even the last five years will serve fully to substantiate the truth of this remark.

But rapid progress is not without its counterbalancing side. There is a possibility that, lured by the attractions of new and

promising fields of inquiry, the mind may be distracted from observing more closely the wisdom that lies at hand. The search after what is new, is apt to blind mankind somewhat to the possible good that remains for discovery even within the circle of what is familiar and known. This, I think, is Dr. Hare's contention in the essay before us. He is not averse to the adoption of new remedies. On the contrary, he everywhere shows his high appreciation of the scientific work and research which are everywhere being pursued. But, at the same time, he thinks several valuable plans and modes of alleviating pain and of treating disease have been allowed to "pass out of fashion." Not, perhaps, that their usefulness has been always despised; but their claims, once honoured, have been superseded by newer and more "fashionable" modes of dealing with disease; and thus the world loses in its progressive march, something of the good it once knew and esteemed. Dr. Hare proposes in his essay to revive and to disinter some of those modes of treatment; and in so doing has really laid public and profession alike under a debt of gratitude. There may be great wisdom in reviewing the work of the past; and assuredly, in matters medical, it would seem as though this aphorism held extremely true.

Our author starts off on his journey of reminiscences with an auspicious topic—that of the decreasing use of alcohol in the treatment of disease, and the increasing employment of milk to that end. Dr. Hare says that twenty-five years ago it was difficult to find a patient who had been but a few hours inside the hospital walls, and who had not already been put on three or four ounces of brandy or double the amount of wine. Nobody can be unaware of the decreasing use of alcohol in medical practice. Doctors have been educated out of this alcohol craze by sounder science showing them the true place and position of alcohol as a factor in health and disease. But Dr. Hare is cautious as well as progressive. He would not practice his profession, he tells us, if he might not use alcohol when and where he finds it needful. Alcohol is, therefore, a "good remedy," which has

wisely been put "out of fashion," because of old the fashion consisted in an abuse of its powers. The reverse is true of milk. There is hardly a disease in which milk is not used for treatment, and this with results of a satisfactory kind. The quantity of milk consumed in 1832 at St. Bartholomew's Hospital, London, cost 684*l.*; in 1882 the milk bill was 2012*l.*; at Guy's Hospital the amounts for these years were 236*l.* and 1488*l.* respectively; and at the London Hospital 426*l.* and 2427*l.* These figures speak for themselves.

Passing now to that very homely remedy, an "emetic" (or agent producing vomiting), Dr. Hare reminds us that, of old, the administration of an emetic was frequently the prelude to the treatment of many ailments. He is of opinion that this is decidedly a good remedy which has too much gone out of fashion. In the early stage of croup, our author would give an emetic. It cut shorts many symptoms, relieves fever, and may, in diptheria, bring up the membranes that form in the throat, when coughing is in vain. In "suffocating bronchitis," too, the effects of an emetic, Dr. Hare says, are "sometimes magical." The want of breath, the terrible difficulty of breathing, and the other distressing symptoms, are relieved by giving twenty-two grains of ipecacuanha in an ounce of water. Almost certain death, says Dr. Hare, may be averted by this well-nigh obsolete practice, which acts mechanically in relieving, by its action on the stomach, the accumulation of the air tubes of the lungs. In a case of severe indigestion, with sickness after food, combined with vomiting, the above-named emetic was found to relieve and cure all the symptoms. The emetic, in other words, by relieving a loaded stomach, gave that organ a chance of recovering its lost tone.

The medical press has long sounded a warning-note about the use and abuse of "purgatives." Every one knows cases in which individuals, in complete health, dose themselves daily with mineral waters or patent preparations of effervescing nature, under the delusion that these substances are necessary

for healthy digestive action. There is no greater delusion. This is the "abuse" side of the question. But there is a reverse aspect, and Dr. Hare points it out for our edification. Of late the professional tendency, he tells us, "has been to neglect them *far too much.*" He tells us that there is entertained a fear that they may produce "debility"—a term our author is perfectly justified in naming "the *bête-noire* of the present medical world." He might, with equal truth, have added that it is likewise the trump-card of every quack, and the one name which, meaningless and exact as it is, strikes terror in the lay mind. "Talk about champagne," says Byron, in one of his letters, "there is nothing which cheers your spirits up like a dose of Epsom salts;" "and," adds Dr. Hare, "in a sense he was right." Sulphate of magnesia (or Epsom salts) has gone "out of fashion," it is true; but, in the form of mineral waters, it appears *redivivus* under a new guise. "There are too many tonics required nowadays," says Dr. Hare; and he re-echoes his opinions in the characteristic expression, "Oh, that men did but know the virtues which reside in three drachms of Epsom salts!" As a means of clearing away from the digestive tract many morbid secretions, the old-fashioned purge has doubtless few rivals.

Half a century or so ago, to bleed a patient for any and every malady was a common practice. Nowadays, there are few medical men who have ever seen or performed the simple operation of opening a vein—so thoroughly has bleeding been relegated to the domain of "old-fashioned remedies." Now and then we hear of protests in favour of the usefulness of bleeding; but the remedy is, to all intents and purposes, obsolete. The "cupper" of the hospital of thirty or forty years ago, is unknown to-day, and, as Dr. Hare remarks, the profession of "cupper" is "now no more found in the 'Post Office Directory' than is that of the Dodo or Ichthyosaurus." In 1832, however, St. George's Hospital used 21,800 leeches; in 1842, 19,600; in 1852, 4500; and in 1882, 400. Indis-

criminate blood-letting, neither Dr. Hare nor any one else will be found to defend; but that, in certain cases, this remedy should again come into fashion, seems to be a conclusion in the enunciation of which Dr. Hare will possibly find considerable support. Our author does not leave us in doubt concerning the cases in which he thinks bleeding may do good. In the strong, robust person seized with violent lung-inflammation, and where the heart's work is embarrassed, and the pulse hard and full, bleeding, he thinks, is of high value. In acute pleurisy, seen in similar subjects, the operation should be practised. Where the right side of the heart (which pumps venous or impure blood into the lungs) is greatly engorged, as in a case of bad bronchitis, where breathing is laboured, and where the patient seems almost at his last gasp, Dr. Hare would bleed, instead of giving stimulants under present-day practice. "Relieve," says our author, "that poor, oppressed, distended heart, and all may be well!" In certain classes of distressing headache, cupping may effect a cure; and nature herself teaches us how such headaches should be relieved, when, in the copious bleeding from the nose which cures the patient, she takes the law of cure into her own hands.

Dr. Hare would also remind us that "dry-cupping," as a means of counter-irritation, is highly useful in such ailments as lumbago, sciatica, and even pleurisy; while dull, heavy headaches may be relieved by the "dry cups" applied to the nape of the neck. "A man," says our author, "for instance, previously feeling perfectly well, is seized, while pulling on his boot, with a pain which grips him across the loins like the clutch of a tiger's paw; to stand up or move one iota from his chair becomes an instant impossibility; the pain—liniments and friction and hot baths notwithstanding—may thenceforward last, though modified, for days, or more. Hot-ironing the part is an excellent remedy; but dry-cupping over the affected muscles achieves a miracle—the patient can forthwith get up, march, and attend to his work."

Such is a brief *résumé* of a highly interesting little work. The high importance of Dr. Hare's teachings, it is clear, lies not so much in the actual illustrations he gives of their successful practice, as in the endeavour to point the moral, that all the good we may know and teach, is not derived from the present alone, and is certainly not wholly hidden in the realms of the unknown.

MIRACLE CURES AND THEIR EXPLANATION.

Recent communications on "Faith-Healing" have evoked a large amount of interest, and have had the effect of stimulating a healthy inquiry into the all-important topic of the nervous system on the body and its ailments. That persons should be cured of even serious ailments by what they are pleased to term "faith," is in nowise surprising to the physiologist. He knows how great and predominating an influence the workings of the brain may exercise over the body in the case of certain persons, and of those possessing susceptible temperaments and nervous constitutions. A person who firmly believes in the probability of a cure being effected in his case by means adopted either by a medical man or by a quack, produces, I believe, a special nervous condition favouring the success of the remedy conversely. We all know how disbelief in the potency of a remedy, or a desponding state of mind delay a cure, may even send a patient into the grave. Every medical man knows of cases wherein the patient has never rallied, or sought to combat his disease. The phrase "Nothing can ever do me any good" expresses a state of mind that frequently gives the death-blow to all treatment. The patient believes he will die, and as often as not the correctness of his belief is borne out by his demise. He has refused to call his nervous system, with its dominating influence, to his aid, and he perishes accordingly, and because the nervous reactions necessary for the due performance of

healing processes have been wanting in his history. On the other hand, there are persons who seem to recover from severe injuries with amazing rapidity. They are intensely hopeful. The prospect of an operation, however serious, never seems to daunt them. I have heard a man lay his plans for his future, with the utmost confidence, just before undergoing one of the most serious operations known to surgery; and the result justified his hopefulness, for he recovered with rapidity from a course of surgical procedure under which a large proportion of patients sink. I have no hesitation, therefore, in saying that in this case, had the patient's disposition been of a gloomy and foreboding kind, he would probably have sunk under the operation. The successful issue of a grave operation on a hopeful man is only another illustration of the song of Autolycus:—

> A merry heart goes all the day,
> Your sad tires in a mile-a.

Recognizing this influence of the nervous system over the body at large, we are prepared to deal with it, in a scientific sense, as a legitimate cause of many interesting results in the way of cures of disease. But because we are not as yet able to indicate the precise *rationale* of the cure in such cases, there is no need that we should relegate them to the domain of the mysterious. Such a procedure is only compatible with a frame of mind which tends to eschew rational explanations of common events, and which finds its analogue in the belief in witchcraft, demonology, and superstition at large. The evil which is wrought by this ignorant attempt to foist supernatural, and therefore utterly unknown, causes upon our attention as the only explanation of so-called "faith cures" and "healing miracles," cannot be over-estimated. In addition to the actual ignoring of plain physiological details and inferences, such a mode of accounting for results fosters quackery and credulity—qualities or conditions which are none the less offensive because they are issued under a religious or pseudo-religious guise. The true method of approaching all such cases is that of, firstly,

insisting upon a knowledge of the actual condition of the patient *before* the alleged cure was effected; and, secondly, of closely scrutinizing the physiological history and surrounding circumstances of patient and cure alike.

An eminently interesting communication, in which the true nature of certain of the so-called "miracle cures" is truly set forth, appears in a volume of "Guy's Hospital Reports" (Vol. XLI., being Vol. XXVI. of the third series), in the form of a paper by Dr. Samuel Wilks, one of the physicians to the Hospital. I regard this paper as one of the most important contributions relating to the influence of the nervous system in inducing and giving disease which has yet appeared. Dr. Wilks takes as the subject of his paper the curious affection called *Hemianœsthesia*, a condition or affection in which *one half* of the body—right or left, as the case may be—loses its sensibility or sensitiveness to all impressions. This disease has attracted a large amount of attention from the fact that certain metals have been alleged to play an important part in its cure.

Now, the seat of this curious affection has not been properly determined. There are cases of loss of sensation at large, due to diseases of the brain; and there are also cases in which non-sensitiveness of one arm and leg also occurs, but where the brain affection shows clearly enough how this loss of sensibility has been caused. The nature of this complete loss of sensation in one half of the body, however, remains a mystery—in so far, at least, as any nervous disease serves as its explanation. "What I have not yet found," says Dr. Wilks, "and am in search of, is a case of pure and simple hemianæsthesia, due to a cerebral (or brain) lesion." Here, then, we come face to face with an affection which, as we shall see, is eminently associated with some curious aspects of nervous action, without association with actual disease of nervous structures. We shall also note how readily such an affection lends itself, unwittingly or the reverse, to the ways or works of modern "miracle-mongers."

The cases of this half-loss of sensibility occur, as a rule, in

hysterical patients, and for the most part in women. In a typical case, pins may be thrust into the affected side without the patient being aware of the operation. While common sensation, or feeling at large, is wanting in these cases, on the affected side, the senses are also absent thereon. That half of the tongue does not taste; the sight is affected; the particular nostril has no sense of smell; and hearing is deficient. As regards sight, Charcot, of Paris, whose experiments form the ground-work of our knowledge of this disorder, finds that the affected eye "may retain its power of discerning form whilst it has lost all perception of colour, the colours departing as a rule in a given series, and returning in the inverse order." Sometimes there are twitching of the limbs, or even "fits" may occur, and it is interesting to observe that along with these nervous ailments there are frequently to be noted in these patients, lapses of a moral kind as well.

In the Salpêtrière Hospital at Paris, Professor Charcot has been accustomed—as we have personally witnessed—to demonstrate the remarkable effects of metals in cases of this "half-sensitiveness," as we may name the affection. If metals are placed, say, on the affected arm, sensibility returns, but differences exist in different individuals in the effects produced by the same metals. When the metal which most readily affects the patient is found, that metal is prescribed internally, and the cure is thus expedited by the administration of gold, silver, lead, or tin, &c., as the case may be. Dr. Wilks mentioned that in about half an hour after the sensation returned to the side, the corresponding part of the opposite arm would lose its sensitiveness. This result was said to be due to a "law of transference." In due time, magnets, galvanism, and other means were also found to be capable of effecting cures; but the cases became more interesting still when it was discovered *that inert and harmless pieces of wood resembling magnets could produce precisely* similar effects to those obtained with the electrical appliances. Hence, as in the case of other

nervous affections, and as has already been shown abundantly in physiological works, the explanation of these cures was relegated to the doctrine of "expectant attention." We come back to the "faith-healing" and to the influence of belief over the body once again. What the nervous patient "expects" is well-nigh certain to happen. If he "expects" a cure, a cure is certain to follow whatever means are employed. If he is sceptical of the success of treatment, the disease remains persistent and intractable.

In a case mentioned by Dr. Wilks, a hysterical woman had no feeling when a needle was run into her neck or scalp on the left side; whilst the right side was highly sensitive. She was deaf on the left side, and "she called all colours by their wrong names." "Two sovereigns were fastened," says Dr. Wilks, "on her left fore-arm. After twelve minutes, she felt the prick of a needle just below the coins. After sixteen minutes, she felt the needle nearer the wrist, and there was some analgesia (absence of pain) on the corresponding side of the right arm. The experiment was continued until she could feel the prick of the needle in other parts, with a corresponding impairment on the opposite side. After a time she returned to her original state, and it was found also that she was quite anæsthetic (or non-sensitive). On the next day, two discs of lead were applied, when, after some time, she could feel a little. Then two iron discs were applied, when sensation returned, with a corresponding loss on the opposite side. Subsequently, gold was again tried, and its effects in restoring sensation being more marked than that of other metals, it was determined to give it internally. . . . At this time sensation was returning in the body, although still absent in the limbs. One night, on going round the wards, the house-physician *found her asleep, and pricked her left hand with a needle; she rubbed it, took it away, and finally, on the irritation being repeated, she awoke. She was then pricked again, and could not feel at all.*" The further history of this case ended with the gradual

recovery of the patient. After a month's treatment, she could feel an ordinary touch and the prick of a needle down to the elbow. In two weeks more she could walk easily, and was soon thereafter sent home. She took the gold for nearly eight weeks; "but," adds Dr. Wilks, "she was not aware of the nature of the remedy."

Remarking on the curious case of "half-sensitiveness" thus described, Dr. Wilks says that, whilst it is impossible to dispute the facts which have been observed regarding the cure of this affection by means of metals, he, nevertheless, doubts gravely the explanations which have been given both of the operation of the metallic remedies, and of the nature and seat of the disease. It has been already noted that cases of this curious affection appear mostly in hysterical women; but it is interesting to discover that they also occur in men. Regarding the explanation of this half-sensitiveness, Dr. Wilks says that in the idea of an arrest of the functions of the brain, in whole or in part, we may find a key to the explanation of certain temporary nervous affections. "If I am right," he continues, "we have only to suppose a cessation of action of half of the brain or a part of it, say the middle and posterior lobes, to account for loss of perception of all kinds, just as we may suppose an implication of the anterior part to result in a loss of power."

Again, speaking of the reason why one hemisphere or half of the brain should cease to act, Dr. Wilks says that in very many instances such an explanation is to be found in the occurrence of "a physical or moral shock." In a former paper our author described the case of a girl, "who, owing to a sudden fright, fell into a state of lethargy, in which she lost the power of feeling as well as seeing or hearing." "If, therefore," says Dr. Wilks, "we simply 'halve' these results, we find an explanation of the 'half-'sensitiveness' of which he is treating." Dr. Wilks adduces a very pregnant fact in support of his theory. "When, for

example, one side of the body is perfectly helpless from disease of one side of the brain (each side of the brain governs the opposite side of the body), the other half of the body is still under the control of its supervising (brain) hemisphere in voluntary acts. There are many persons who from infancy have had a wasted hemisphere, and a correspondingly withered half of the body, and have yet retained their individuality and their power over the healthy half." The false nature of alleged "faith-healing" becomes apparent when we reflect, that, if in the case of the girl above described, her full nervous powers had returned under the stimulation of a period of religious frenzy and excitement, she would undoubtedly have been made to pose as an example of a "miracle-cure." In such a case, the mental and nervous excitement, itself accompanied by physical actions and changes in the nervous centres, simply acts as a natural stimulus, similar to the hopefulness of a patient which carries him safely through the difficulties and dangers of a serious surgical operation.

Many other organs of the body exhibit alternating periods of activity and quiescence, such as, in Dr. Wilks' views, part of the brain and nervous system may occasionally illustrate. The actions of the stomach, liver, &c., may also be very strikingly affected by sudden shock and mental emotion. It is not surprising, therefore, that where the brain itself is affected we should see results, and also witness cures, which, to the ignorant or uninitiated, appear little short of miraculous, and inexplicable save on the theory of supernatural interference.

There is a noteworthy point in connection with these cases of nervous affections which must be borne in mind in judging of their probable causes and of the nature of their cures. It is often extremely difficult to obtain accurate accounts of the state, feelings, and powers of these patients, owing to the moral obliquities and perversions which accompany their affections. Westphal, in the course of his researches into the effect of metals on "half-sensitiveness," says that the results described

by Dr. Charcot appeared correct, but that "it was remarkable that every one of his (Westphal's) patients had been in contact with the criminal law."

But the most striking illustration of the relation of nervous influence to "miracle cures," is certainly afforded by the case of Albert R., who was admitted on July 16th, 1881, to Guy's Hospital, under the care of Dr. Wilks. He was brought to hospital by the police, having been found insensible and convulsed in the streets. The account he gave of himself, prior to his admission to hospital, included a recital of Australian life, fights in New Guinea, and so forth; and, in addition, the history of an illness in June, 1881, for which he was treated in the London Hospital. According to Dr. Wilks, however, the patient's story, from the nature of his after-conduct, cannot be relied upon. On being examined at Guy's, his left arm and leg were paralyzed, but neither face nor tongue were affected, as would certainly have been the case had the seizure been due to apoplexy. From the whole of his left side, sensitiveness was absent. With the left eye, he could not distinguish colours, and could only make out light and darkness. Hearing in the left side was gone, as also were smell and taste. The senses on the right side were natural. He had a convulsive fit in the evening of his admission; his right limbs being thrown about, but the left remaining quiet. July 19th found him so noisy that he was transferred to a strong-room, and, although inflammation of the brain was suspected, "his strange manner raised a suspicion of malingering"—that is, of feigning disease. On July 21st water was injected into the arm instead of the morphia with which he had been treated, when he immediately quieted down for some hours, talking sensibly, and asking to be sent back to his ward. But the sensibility in the left side was still wanting. The water-injection was continued with the same effect for some days, and metals were applied to his arm and leg. On July 27th he could move his limbs a little, and was sitting up in a wheel-chair. On July 30th Dr. Steele

informed him that the Duchess of Sutherland had written enclosing a sovereign, and saying she wished him to come and fetch some money she had for him. That evening he complained of pain in the left leg, which, however, he was able to move as well as the other. On the 31st he walked up and down the ward with assistance, but said he could not move the left arm, the limb falling helplessly when raised. He was seen, however, to use this arm occasionally to support himself. He was then told he could not be allowed out that day, and in the evening he could scarcely walk.

On August 1st he was allowed to go out to see the Duchess, and got up and walked about. Sensitiveness was returning to his limbs during the next few days, but his senses were "still dull." In the middle of August, 1881, he left Guy's. He was then able "to walk very well, and to move the left arm partially," but sensitiveness had not completely returned. "He said he was well enough to work," and left with that object.

The sequel, however, is highly interesting and instructive. Dr. Wilks heard no more of Albert R. until his name was discovered in a French religious journal of October 7th, 1882, called the *Rosier de Marie.* This journal, quoting from the *Journal des Lourdes*, gave an account of a pilgrimage which had been taken to Lourdes by the Archbishop of Cambrai and numerous followers. In that pilgrimage Albert R. was included. He had been a patient at Lille Hospital; all his symptoms had apparently returned, and he had apparently been furnished with a wooden leg in addition to crutches.

The scene at Lourdes must have been curious in the extreme. Albert R. descends into the spring or grotto ("*piscine*") wherein the cures were effected. "My brethren," said the Archbishop, with tears in his eyes, "let us tell our beads twenty times for the sick of the pilgrimage of Cambrai. As he concluded, a cry was heard from the grotto, and soon thereafter a man, still young, advanced trembling with emotion, and carrying in his

hands two useless crutches. It was Albert Rose, of the Lille Hospital, afflicted with hemiplegia (half-paralysis) and hemi-anæsthesia (half-sensitiveness) of the left side, at the end of an unsuccessful operation for trepanning. He only walked with two crutches, and the left knee supported by a wooden leg. He had also lost the use of the left eye. The physicians of the Medical Congress at London had declared him incurable.[1] Plunged into the grotto, amidst the prayers of the people outside with the holy Archbishop, the leg all at once extended itself, and his left eye opened to the light. He was completely cured."

On hearing of this "miraculous cure," Dr. Wilks wrote to Dr. Béchamp, of Lille, who afforded all the information he could gain ; the hospital physicians, however, being unwilling to give an opinion, as the case was "under investigation." *The patient, however, as was learned from one of the letters written by a hospital physician, experienced a return of all his symptoms when he returned to Lille, and became an inmate of another hospital.* The following is the extract referred to :—"He had been treated, under my care, for epileptic fits and for hemiplegia with half-sensitiveness. When he left, his state was not notably improved. He went to Lourdes, and was suddenly cured in the presence of many witnesses. On his return to Lille, movement and sensibility had returned. I did not witness it myself, since I was absent, but several of my students, who knew him, attest the fact. We had lost sight of him for several weeks, and yesterday a letter informed me that he was entered at the Hospital de V., presenting the same symptoms as before, and seeking to conceal his identity by pretending

[1] This statement receives the most direct contradiction from Dr. Wilks. Albert R. was not shown to the International Medical Congress at London. He was simply shown to Dr. Lancereaux, who visited Guy's Hospital with Dr. Wilks. Needless to say, neither Dr. Wilks nor Dr. Lancereaux pronounced him "incurable."

that the miracle-cured at Lourdes is his brother, and not himself."

The "miracle-cures" have been described by a believer therein, Mr. Clarke (S. J.) having given an account of these events in the *Nineteenth Century* for November, 1882, in a paper entitled "Modern Miracles." One of these cases cited by Dr. Wilks is that of a woman from Louvain, who had been paralyzed on the left side for seventeen months, and exhibited all the symptoms already described as those of "half-sensitiveness." "Whilst praying in front of the grotto, all at once she cried out, 'Sister Pauline, my fingers are moving.' A few minutes after a sharp pain pierces her arm and side, and she feels that she is cured. The same afternoon she appeared before the Commission appointed to examine alleged miracles, and in the presence of two physicians walks, runs, carries heavy objects about with her left hand, sees perfectly with her left eye, and hears perfectly well with her left ear." It is to be hoped that the Commission was perfectly familiar with the effects of metals on the affection which gave way to the "miracle-cure," and it would be interesting to learn if a cure by coins or by a sudden shock would have been deemed equally "miraculous" with that effected as the result of the strong mental emotion at the shrine of Lourdes.

Side by side with the incident just mentioned, let us place one of Dr. Wilks' own cases. Here a female teacher, hysterically inclined, had been ailing for two or three years. She "often lost the use of her limbs, or lost feeling in them." Her right side was destitute of sensibility when she was admitted to hospital, and the senses were, as usual, imperfect. Four sovereigns were next day tied round the leg, but without effect, and after repeated experiments, the patient remaining for seven months in hospital, no cure could apparently be effected. She was accordingly discharged in the same state as on admission. Some weeks thereafter she was again re-admitted, on the earnest

solicitation of her mother. Dr. Wilks then determined to follow his "own and well-tried method." This was to give her some moral discipline, and leave all medical treatment alone, as it so often perpetuates hysterical ailments. "I ordered her nothing, and systematically passed by her bed, saying in her hearing that I could give no more trouble to her case whilst so many persons really ill required my attention. In fact, I neglected her for a purpose, when one day, after two or three weeks' time, I found her out of bed, sitting dressed in a chair at its side. I then spoke to her, and she told me that she could walk a little, and she thought she was regaining some feeling in the right side. I expressed my satisfaction at the turn her case had taken, and hoped she would now speedily get quite well. This she did not fail to do, as she daily grew stronger, and soon left the hospital quite well." Such a case is a striking commentary on the Lourdes "miracles," and on "faith-healing" at large. If this girl, who was cured simply by moral influence, had, through strong emotional stimulus, recovered her sensibility and power of movement in some religious exercise, her case would, undoubtedly, have figured as a "miracle-cure" of the paralyzed!

In Mrs. Oliphant's "Life of Edward Irving" there is a striking example (Vol. II., Appendix A.) of a cure of an hysterical case which certainly corresponded to the "faith-healings" of modern times. The patient herself describes her case. In November, 1822, she was affected with what she terms "hip disease;" and in September, 1828, she returned home "as unable to walk home as when leaving." From this time no means of cure were used except "constant confinement to the couch." On October 20, 1830, the patient was visited by "a kind friend who had seen me about two months before," and who "had been led by God to pray earnestly for my recovery. . . . Sitting near me we talked of his relatives and of the death of his brother. . . . After asking some questions respecting the disease, he added, 'It is melancholy to see a

person so constantly confined.' I answered, 'It is sent in mercy.' 'Do you think so? Do you think the same mercy could restore you?' God gave me faith, and I answered 'Yes.' . . . '*Then*,' he added (after a few questions, between which 'he was evidently engaged in prayer'), '*get up and walk to your family.*' He then had hold of my hand. . . . *I rose from my couch quite strong.* God took away all my pains and we walked down-stairs.' . . . Having been down a short time, finding my handkerchief left on the couch, taking the candle I fetched it. The next day I walked more than a quarter of a mile, and on Sunday from the Episcopal Jews' chapel, a distance of one mile and a quarter. . . . It is material to add that my legs, the flesh of which was loose and flabby, *feeling them in a short time after I walked down, were firm as those of a person in full health.*' (There is an unconcious testimony in these words to the purely nervous and hysterical character of this person's affection. It is almost needless to add that had she been afflicted with true paralysis, the muscles would have undergone serious structural change and wasting.) The back which was curved is now perfectly straight. (This feature is again a familiar hysterical one, and similar cases, erroneously called those of 'disease of the spine,' are reported from the recent 'faith-healing' experiments.) My collar-bones have been pronounced by a surgeon to be in quite a natural state, whereas one of them was before much enlarged."

The conclusions to which the impartial mind must be led, as a matter of science, regarding the nature of explanations of "miracle-cures" appear tolerably clear from an analysis of the cases detailed in these articles. We thus discover that such cases as have come under exact observation, are of the *hysterical type*—a phase of nervous action, the forms of which are legion, and in which the symptoms of almost every other affection may be accurately imitated. It is an easy matter for the uninitiated to assume that because a patient says he (or she)

is afflicted with grave spinal disease that affection must really exist. But when we reflect on the subtle nature of hysterical affections, on their imitative tendencies, and on their long persistence, we cease to feel surprised that they are mistaken for diseases of incurable nature. The real truth is that they require, as often as not, only some strong mental stimulus to cause them to completely disappear. Even cases of assumed paralysis cured by "faith-healing," turn out, as we have seen, to be merely cases of a peculiar nervous affection, readily enough relieved by the mental impressions produced by contact with metals, with magnets, or even, as we have seen, with plain water or "dummy" magnets. "The remedies," says Dr. Wilks, speaking of "half-sensitiveness," "have been ordinary medicines *of every description*, the continued application of metals, of galvanism, of magnets, and solenoids, the application of discs of wood and mustard plasters; also the use of the diapason, the waters of Lourdes, charms, and simple neglect." In the idea of the influence of metals, Dr. Wilks has evidently no faith. "A sovereign retained in the pocket of Albert Rose," he remarks, "had a more striking effect than the temporary application of gold to the skin or its administration in minute doses internally."

The closing words of Dr. Wilks' paper are worth quoting. Speaking of the arrest and sudden starting of brain-function, to which he conceives the paralysis we know as "half-sensitiveness" to be due, he says such action reminds him of a watch which a schoolfellow possessed, and which was "the envy of all the other boys. It had this remarkable property, that when the owner took it from his pocket, although it might give the right time, it was found to have stopped. The sudden pulling it from his pocket had arrested its movements. He would then give it a sharp knock, and send it on again. The balance was in a state of unstable equilibrium, and was thus ready to stop or move on again under any jarring influence. The brains of these poor hysterical people seem in like manner to stop working on

receiving a shock, whilst another shock will start them again."

It is only right to add the opinion that researches like those of Dr. Wilks, in addition to their high medical value, possess the important function of combating superstition, of dispelling illusion and quackery, and of vindicating "true religion and undefiled" from the charge of being the plaything of the credulous and the weak. The "faith-healing" and "miracle-cures" of to-day are merely the names of the ignorant or fanatical for very ordinary and familiar methods of relief, allied to those whereby we cure an ordinary case of hysterics.

THE CASE OF LOUISE LATEAU.

A few weeks ago (1883), the daily newspapers contained reports of the death of Louise Lateau. To very many, in this country at least, the mention of the name must have awakened no curiosity; yet, in her way, Louise Lateau was a distinct personality of our time, and her name figures in the text-books of medical science as a noted example of some of the most curious bodily and mental associations which it has been the lot of the physiologist to study. A few years ago, much interest was excited in this and other countries, but especially in Belgium, by the announcement that a girl had exhibited wonderful powers of fasting, and that sundry other features in her case appeared to bring it, in the opinion of certain observers, at least, within the domain of the miraculous itself. In the course of the preceding paper, it was shown how such cases lie as completely within the explanation of modern medicine and physiology, as do the functions of the heart or the working of the lungs. Only ignorance and credulity can rest satisfied with an appeal to the miraculous, when science appears on the scene with a plain explanation of

what is mysterious or apparently inexplicable. The investigation of such incidents in the history of human ways and works, does not involve any considerations of a religious kind. There are no real religious interests involved in the examination of a case of supposed "miracle-cure" any more than are included in the investigation of a brain-disorder or of eye-disease. It is only the foolish and credulous, or the designing, who can dare to make "religious" capital out of the weaknesses or the diseases of humanity. It is needless to add that the best interests of religion really demand the full and free examination of all such cases, if only on the ground that it is the duty of medical science to render aid, advice, and, if possible, consolation, in the relief of suffering and the cure of pain.

Louise Lateau was born in the village of Bois d'Haine, near Mons, in Belgium, in 1850. Her father was a miner. He died of small-pox when Louise was a week old. The child contracted the disease, recovering from it only to pass into a weakly childhood, which appeared to be the natural consequence of an originally feeble and debilitated constitution. The fact of the girl's weakly state becomes an important one when the details of her history are more fully investigated. Beginning life thus in a somewhat abnormal state, it is not surprising to discover that this primary weakness asserted itself through mind and body, and that in a somewhat remarkable fashion, as we shall presently see. When Louise Lateau attained the age of seventeen, her symptoms became much aggravated. By all accounts, she was in danger of falling into a decline. Whether this "decline" was a veritable feature in her physical history or not, may be judged from the fact that, on attending church during 1868, on Good Friday, and receiving the sacrament, she became suddenly cured of her wasting disease. It was at this stage of matters, also, that Louise Lateau began to exhibit those symptoms or appearances which gained for her a more than local celebrity and fame.

These symptoms certainly presented a most remarkable character, equally to the physiologist and the ordinary observer. Wounds appeared spontaneously on the left side, the front and back of each hand, the upper surface of her feet, while a row of small bleeding points in due time formed on the forehead. These marks, which resembled the "stigmata" or imprints of the Passion, bled every Friday. The mark in the side was the first to exhibit this peculiarity; the other bleeding spots having established themselves a few months later. Each Friday also, Louise Lateau fell into fits of "ecstasy." These fits began about 8 or 9 a.m., and ended about 6 p.m., and are described as having interrupted her when engaged in prayer, in conversation, or in ordinary manual occupations. During the progress of these weekly "ecstasies" a series of "visions" appeared to this girl; while it was asserted that from 1868 till the period of her death, Louise Lateau had ceased to take or to require food. To the reputation of being endowed with special marks of Divine favour, in the shape of the "stigmata" or bleeding points, she thus had added the miraculous power of being enabled to exist without food. The case of the "Welsh Fasting Girl" amongst ourselves, was thus paralleled in highly significant fashion in Belgium.

Of the ecstatic fits to which Louise Lateau was subject, she retained a vivid impression, and was thus able to recount to her hearers the visions she had seen. She described how at first she felt as if she had been suddenly plunged into a vast flood of light and effulgence. From amidst the brightness, the forms of men and things were gradually evolved. The scenes of the Passion were thus displayed before her mental gaze, and she was able to give a minute description of all the details connected with the event in question. The observer was able to trace the progress of the vision by the various actions performed by the girl. At 3 p.m. she regularly extended her limbs in the form of a cross. The fit ended in a state of high prostration. Her pulse was described as low and

feeble; the breathing was weak; and the whole surface of the body was bathed in a cold perspiration. After a continuance of this state for a few minutes she gradually recovered her wonted condition.

Of such a case it was not surprising that much should be made by the credulous, or by those who, ignoring the existence of any scientific side or aspect to the facts, should regard them as testifying to some miraculous revelation of superhuman and divine nature. As a matter of fact, Louise Lateau became regarded as a sacred personage. Her dwelling-place became a kind of shrine. Her cottage was guarded by priests and by ecclesiastical authority; for admission thereto, could only be had by permission of the curé of Bois d'Haine, and visitors were scrupulously scrutinized, and the purport of their mission criticized before the "patient" could be seen. As regards the facts of the bleeding-points in the skin-surface there seems no reason to question the veracity of the statements which assert their existence and their periodical discharge. But there can be no hesitation, of course, on the part of all sensible persons in rejecting the stories of the miraculous fasting of Louise Lateau. The only testimony forthcoming in support of this latter feature of the case is that of a professor connected with the Catholic University of Louvain. And as this gentleman's evidence only amounted to the declaration that Louise Lateau never ate in his presence, his testimony left the question of her "fasting" exactly where common sense and science would alike allow it to remain.

Louise Lateau thus became a personage of note. She was taken, as we have seen, under the direct patronage of her Church. Crowds visited the "Stigmatisée," and even medical journals were found to debate her claims to be regarded as above the rank both of an impostor and of a scientific phenomenon, with a warmth which, as has been lately remarked, did not seem warranted under the circumstances. No independent scientific examination of her case was permitted, and

the girl was allowed to remain as an object of superstitious—and we will add, with all due respect to the convictions of her admirers and devotees, of ignorant—devotion. The death of Louise Lateau, however, once again brings her case to mind. The scientific explanation thereof is found, as in that of many other mysterious cases, in the parallelism which can be drawn between the facts of ordinary physiology and those of disease. Louise Lateau was simply a weak, hysterical girl, in whose case "a dominant idea"—that of the Passion and its events—ruled all else out of her life, and affected, as strong mental impulses are known to affect, the physical structure of the body. The blood circulation seems specially liable to be affected by the mental state. We know of a case in which, under strong mental excitement, a person's skin on the right shoulder and neck becomes of a violent red hue. In another case, the skin of the forehead, under agitation of mind, becomes almost livid. Carried a step further, such a feature might be followed by the straining of blood through the skin-pores, although in such a case, of course, no miraculous result would be inferred.

In the case of Louise Lateau, then, we once again see the effects of a strong mental idea acting upon the body, and directed in harmony with the ruling thoughts of the patient. An incident, which to our mind is quite as curious as the case of this Belgian girl, is related by Carter in his "Pathology and Treatment of Hysteria." A lady saw a window-sash fall on the hand of her child and cut off three of the fingers. A surgeon having dressed the wounds, had his attention directed to the mother, who sat moaning and complaining of pain in her hand, which had, of course, been uninjured, and in which, prior to the child's accident, no pain had existed. On the hand being examined, *three fingers, corresponding to those injured in the child, were found to be swollen and inflamed.* In due course, these fingers suppurated, were incised, and the wounds ultimately healed. Here, as in the case of Louise Lateau, a "domi-

nant idea" was propagated from mind to body, and wrought out in the personal history of the patient; effects which, had their origin been unknown, would have undoubtedly been referred to the operation of disease.

PLANTS IN BEDROOMS.

The health-topics connected with plant-life in bedrooms come frequently to the front in ordinary life, and are commonly discussed with reference to the supposed injury which plants are capable of inflicting on the sleepers. To understand perfectly the rights and wrongs of this matter, is by no means a difficult task. We only require a slight knowledge of plant-life and its functions to enable us to determine whether or not plant-life is dangerous to animal life at night. Primarily, one might say that a sleeping apartment is hardly the most suitable place for the growth of plants—in an æsthetic sense, at least. In ordinary experience, one sees plants in bedrooms chiefly in country districts, and for the most part in cottages, where room is limited, and where tastes botanical have but little space for their full gratification. Still, the problem is one of health; and as the topic appears to be a highly debatable one, where the debaters, at least, possess little knowledge of plant-physiology, it may be well that we should endeavour to see what botanical science says on this head.

A green plant differs widely from a non-green plant in its habits, food, and life at large. The green colour of plants is due to a compound known as *chlorophyll.* The presence (or absence) of this matter makes a paramount difference in the world of plant-life. A fungus, for example (*e.g.*, mushroom), which possesses no chlorophyll, resembles an animal in its feeding. It subsists on organic or living matter, usually in a

state of decay; it inhales oxygen like an animal, and exhales carbonic acid gas like the animal hosts around. As a matter of fact, fungi and other non-green plants (*e.g.*, dodder, &c.) live either on decaying animal or vegetable matter, or upon fresh living matter. In the latter case they are *parasites*. The mistletoe, which is a parasite, derives so much of its nutriment from the tree to which it has attached itself; but, having green leaves of its own, it can elaborate a little food for itself, and thus preserves a certain likeness to its normal plant allies. But a fungus which breeds in the skin-tissues of animals, like that which causes ringworm, or those which cause other parasitic skin diseases, are thoroughly animal in their nature. They feed upon the living tissues of their host, and in this respect are more nearly allied to animals than to plants.

A green plant, on the other hand, is a far more typical plant than its non-green neighbour. The green plant is satisfied with *inorganic* or non-living matter for its support. It firstly demands *water*—although in this respect it certainly resembles all animals, man included, and all other plants. The second item in its bill of fare consists of *minerals*, and of these, green plants have at command a tolerably large selection—a feature in which also they present a resemblance to other plants and to animals. The third demand of the green plant is for *ammonia*, which it takes up from the soil for the sake of the nitrogen that compound contains. Last of all the plant requires *carbonic acid gas*, which, as most of us know, is breathed out by animals, and which is itself a source of danger to animal life if breathed in sufficient quantity or for a sufficiently long time. This carbonic acid gas is composed of the elements Carbon (C) and Oxygen (O), and in chemical language is accordingly spoken of as CO_2.

Now, *in the presence of light*, a *green* plant—in virtue either of its chlorophyll alone, or, as some authorities maintain, by aid of this green matter and the living protoplasm of the plant combined—is able, firstly, to absorb carbonic acid gas from the

atmosphere; and secondly, to decompose it, or to split it into its two elements. In the latter operation, the carbonic acid (CO_2) is, therefore, resolved into its component carbon (C) and oxygen (O); and the *carbon* is retained by the plant as part of its food supply, whilst part of its oxygen is set free and is allowed to pass back to the atmosphere. The carbon retained by the plant unites with the elements of the water it has absorbed, to form the various substances or compounds (starch, &c.) of which the plant is built up. Thus, to put the matter as popularly as possible, that which the animal breathes out (*carbonic acid*), the plant takes in; and what the green plant breathes out (*oxygen*), the animal inhales as part of the air it inspires. A green plant growing in the light is, therefore, so far, an atmospheric purifier, in that it removes from the air the gas which, as a product of animal waste, is in itself injurious to animal life.

But, in the absence of light, it would appear that the functions of the green plant undergo a very striking modification. Doubtless, at all times, the green plant, like the animal, demands a supply of oxygen for the due maintenance of its vital functions. "Respiration," or "breathing," which, in the animal consists in the inhalation of oxygen, and the exhalation of carbonic acid gas and other waste matters, also goes on in plants. It seems, in truth, that, for the life of a plant, oxygen is as necessary as for the animal. It is in the work of nourishment and assimilation that we see the green plant taking in carbonic acid gas as part of its food; but it would also seem as if, hand in hand with this process, the plant gave off carbonic acid gas as part of its useless products. This is really the case. We should bear in mind, however, that the former process, that of nutrition (whereby carbonic acid gas is taken in and oxygen given off), is a rapid and active process, whereas the opposite action by which oxygen is received and carbonic acid given off is a relatively feeble one. By the former process, as we have seen, starch and other compounds are formed in the

plant; and as it can only take place in the light, plants grown in the dark do not form starch but lose weight, and finally die. It is also interesting to learn that a plant will die suffocated, like an animal, if placed in an atmosphere of pure carbonic acid gas.

Turning, lastly, to the case of the green plant at night and in the dark, we see there that whilst the process of starch-formation, the splitting of carbonic acid, and the exhalation of oxygen practically cease, the "breathing" of the plant continues. That is to say, in the dark, the green plant undoubtedly, as in the day, will give off carbonic acid gas, like the animal. In this light, it may be thought that plants in bedrooms must necessarily be injurious to health from this exhalation of carbonic acid gas. But, as a recent writer remarks, "most people know that carbonic acid gas is poisonous, and it is very common to hear people talk as though a pot or two of geraniums might be expected to choke them in their sleep with the noxious fumes given off. It may interest such persons to know that experiments have been made with the view of determining precisely what is the effect of plants on the night air. Volumes of air were taken about the middle of the day from various parts of a conservatory containing 6000 plants, after it had been closed for twelve hours. Out of 10,000 parts there were found to be 1·39 of carbonic acid. Now the purest of air out of doors contains ordinarily about 4 parts in 10,000 of carbonic acid. There is always more or less of it in the freshest of breezes, and the difference between the 4 parts in the open air and the 1·39 in the greenhouse was due chiefly, no doubt, to the action of the foliage. The air of the same greenhouse was similarly analyzed just before sunrise, and the carbonic acid amounted then to 3·94 parts in 10,000, or as near as possible to the proportion always met with in the open air. The action of the plants during the hours of darkness was thus barely sufficient to neutralize the production of oxygen during the daytime and scarcely brought up the terrible carbonic acid to the

normal proportion in the atmosphere. This, it must be remembered, was the effect of 6000 plants in a single apartment. It seems pretty safe to assume that the mischief of a dozen or two in a bedroom is theoretical rather than practical, and that those who like flowers in their bedrooms may indulge their fancy quite safely."

The latter conclusion appears, therefore, to be a sound one; although it should also be borne in mind that certain plants may throw off much larger quantities of carbonic acid gas than others. In any case, where flowers are grown in bedrooms, there should, at least, be free ventilation; and with this latter condition fulfilled, it would seem that plant-growth, under such circumstances, has but little, if any, deleterious influence on health.

DISEASE AND ART.

The function of the poet, as one of our greatest thinkers puts it, is to be true to nature. Possibly there can be, as things are, no higher or better criterion of poetic art than that which recognizes in the efforts of the poet the attempt to convey lessons or ideas of worth as these ideas are represented in the external world or in the nature of man. The poet who was colour-blind could not discourse truthfully concerning the greenness of the grass, the hue of the flower, or the tints of the sunset. If such a writer described the appearances and ways of living beings, keener observers of nature, although more prosaic in their words, would be entitled to assume that the poet was no trustworthy observer, and as little to be regarded as the interpreter of that which is beautiful and true. Even the rhapsodies of poetry are only powerful when they at least reflect the truth as it is in nature or in man. Sooner or later the false simile, or the absurd and erroneous metaphor, will be detected and exposed, and, by as much error as after-observation detects in

the poet's works, will his claims to rank high or low in the exalted circle be estimated and judged. What is true of the poet, holds true with greater force still of the painter and his work. He, more directly than the poet, perhaps, is concerned in the depicting of the true as it exists in nature. If he draws an elf, his work will be judged by the laws which use and custom, founded on tacit ideas of misshapen humanity, have established. The fairies that revel in the moonlight must be symmetrical beings, capable of criticism by anatomical rules, and presenting no marked infractions of the conventional ideas of form and feature to which the painter himself owes their creation and evolution. With humanity itself as the subject of his art, the painter's work must submit to criticism of a still more fixed and stable type. There is not one rule of art-criticism for the painter and another for the anatomist. An error in the anatomy of the "Quoit-thrower's" arm is the "little rift" within the poetic lute; and a misshapen trunk or a lack of proportion would have condemned the Apollo Belvedere, or the Venus de Milo herself, to the limbo of forgotten non-entities. Trees and flowers, sky effects and rainbows, possess features which the student of nature recognizes as constant and unchanging. The wholesale variety of nature merely overlies a stable and unvarying constitution. If Nature seems capricious in her moods, the uncertainty, after all, is a matter of limitation; and no artist can afford to play fast and loose with so-called "effects" of sun, sky, water, trees, and flowers, any more than he can attempt successfully to depict the human form in other guise than that which its anatomical examination and symmetry disclose. Science, in short, appears on the scene as the censor of Art; and Art is wise when she cheerfully accepts the criticism Science bestows.

If this is true, however, of mere scientific details of man and nature, as depicted by the painter, the idea of scientific criticism is somewhat less feasible when applied to prevailing tastes in art. There is no canon whereby artistic "taste," as

such, can be judged. To some eyes, a "fashionable," pinched and waspish waist, with broad shoulders, and hips that bulge relatively to the corset-girdled chest, may present a figure beside which the Florentine Venus herself is of none effect. Yet it might be impossible to convince such a mind that his taste was debased; for there is no common ground from which an argument might be conducted. So, also, the rosy cheeks and rude health of the country lass might be regarded by many as savouring of vulgarity; and if such an opinion were really expressed, how is the standard of taste, which prefers the ghastliness of the anæmic or bloodless cheek, to be refuted or deposed from the seat of authority? To revolutionize "taste," then, is a matter of singularly difficult and complex nature. By many, the labour may be deemed futile and impossible. Given a prevalence of taste in a certain direction, and a preference for a particular mode of fashion, and all the efforts of science and reason combined, will not avail for the extinction of what is admittedly abnormal and erroneous when judged by ordinary rules of common sense.

In the art world of to-day there appears a tendency which, so far from presenting us with examples of the pure, healthy, and beautiful in nature and humanity, may legitimately be described as devoting itself to the worship of actual disease. We are all familiar with the outrageous absurdities of the so-called "æsthetic school" of art. The inanities of those who imagine that a maudlin phrase solves the mysteries of beauty and being, have been more than sufficiently satirized in the comic journals, on the stage, and by healthy art-criticism itself. But the craze continues. It crops out in our picture-galleries, it shows itself in art tendencies elsewhere, and it even repeats itself in our architecture when it contracts our windows, deprives us of Heaven's good gifts—light and air,—and causes us to sit in the semi-obscurity of an irrational and meaningless gloom. Let the candid observer glance around the picture-galleries, and observe how the modern artist of the school to

which we allude, delights to wallow in the air of the sick room, and amid the atmosphere of the hospital. We have in our mind's eye more than one painting in which the females represented are depicted with the pale, weary, sallow, and unhealthy complexions that one sees in the waiting-rooms of medical men and in the hospital wards. The idea that the painter had chosen his models from the dispensaries is, after all, justifiable enough—unless, indeed, the young ladies, in the language of Mr. Gilbert's "Patience," are "not quite so ill as they look." There is not a healthy flesh tint in any one of the paintings to which we allude. The medical mind, gazing at such productions, feels tempted to burst forth into recommendations of iron and sea air as tonic remedies. The figures are lean and scraggy. Painful muscular prominences, particularly in the neck region, seem to indicate that the ladies in question suffered from rapid emaciation and general wasting of tissue at the period of their artistic delineation. "Æsthetic" jaws—which are lean—match "æsthetic" necks, which are long and attenuated; and in one case, wherein certain females are represented by the waters of wailing, the ingenuous mind might feasibly enough account for their tears on the theory that they had been grievously afflicted with severe bodily illness.

Science has to repeat, in the face of these æsthetic follies, that whatever the artistic excellence of the paintings, the artists are pandering to a diseased and not to a healthy taste. There is surely beauty enough and to spare in this world, without the need for depicting men and women in the semi-nudity of wasting disease. If this be "taste," we admit that no argument can avail against its prevalence. That which people prefer, in art, becomes the law and canon of their art-life. But we have still faith enough in the healthy tone of English art to believe that the national common-sense will never lapse into the morbid half-lights of the "intense" school. There can surely be no need to fear that, as a cultured nation, we shall come to prefer the tenants of the out-patients' room,

and their pains, as art-subjects, over the purity of body that reflects the influences of fresh air, good food, and the other attendant conditions of health. Art should be the minister of health and not the servitor of disease.

A FEW WORDS ON BATHING.

When the bathing season of each year approaches, it may not be amiss if we give a few timely hints regarding the practice in question. No form of recreation, wisely used, is more conducive to health than bathing. Conversely, no exercise is more injurious than bathing when injudiciously practised, and no exercise, it may be added, more readily contributes to ill-health, or to derangement of important functions, than unwise participation in the delights of the river or sea.

A primary caution which should be strictly observed by all bathers, is that of first ascertaining, in any doubtful case, whether or not the constitution is adapted for the exercise. As a general rule, the healthy person, male or female, can bathe without fear or risk. Assuming that there is no weakness of chest—heart or lungs—and no tendency to deficient circulation, bathing may be safely indulged in, according to the rules to be hereafter laid down. Where a feeble circulation exists, or where lung or chest complaints have existed, then the exercise must be very guardedly begun; ceased on the slightest sign of indisposition; and not again persisted in, save after medical sanction has been obtained. Many an attack of pleurisy has been laid to the account of an injudicious bathe; and other chest complaints have been aggravated through persons bathing, who should never have entered the water.

The common contra-indications to bathing, or the signs which should teach us that bathing is injurious, are readily appre-

ciated. Where a chilly sensation is felt on leaving the water, even after having been a reasonable or proper time immersed, some cause must exist which demands investigation. It is a notable fact that any cause which lowers the system—fatigue, common ailments, want of tone, &c.—predisposes chill in bathing. Very often the bathe which, under ordinary circumstances, refreshes and invigorates, may thus act as a pretty safe guide to the state of the general health. Curious peculiarities are observable in individuals in reference to bathing. Thus certain persons suffer persistently from headache when they bathe in sea or river, whilst the daily bath at home may have no such effect. Again, bathing in the sea has been known to be followed by a lassitude and headache, whilst a dip in fresh water has no such result. These peculiarities should be borne in mind, for, although their causes are obscure, they yet indicate pretty accurately that for health's sake the practice should be abstained from.

Sea bathing is regarded, naturally, as more bracing in its character than river bathing. The saltness of the water and the sharp air of the sea together tend to invigorate us. As a rule, the bather can remain longer, without injurious effect, in salt than in fresh water. The sudden shock which results from a plunge into river or sea may be attended by bad effects in the case of persons who are subject to fits of any kind or to disturbance of the heart's action. Another highly important caution in bathing has reference to the care of the ears. Wherever any tendency to ear-ache or inflammation of the ear exists, bathing must be cautiously indulged in. A dive has been known to be followed by rupture of the "drum" of the ear owing to the sudden pressure to which this membrane has been subjected in passing from the air under the water. Again, persons who have suffered from discharges from the ears—common after scarlet fever, for example—and in whom the drum of the ear may be perforated or irritable, abscess of the brain may follow injury produced by the sudden dive or

by plunging the head beneath the water. One of the most eminent of our English judges died from an injury of this description. The placing of cotton wool in the ears is to be recommended in bathing, as a necessary precaution in all who have tender ears, and as, in fact, a safe practice for all.

Attacks of cramp, to which even expert swimmers are liable, may arise from many causes. Where special nervous diseases do not exist, the so-called "cramp-spasms" are, as likely as not, due to some irregularity in digestion, or to some imprudence in bathing at wrong times and seasons. Bathing after a full meal may induce so-called "cramps," and it is to be feared that many a fatal case of drowning, attributed to some hidden nervous cause, has had a far simpler origin in digestive disturbances re-acting on the nervous system, and through this system propagated to the muscles.

The ordinary rules—drawn up by the Royal Humane Society—which should be observed by all bathers, whether in fresh or salt water, and whether swimmers or not, are simple and readily borne in mind.

1. Never bathe within two hours after a meal.

2. Never bathe when exhausted or in ill-health. The practice of plunging into the water after exercise is to be thoroughly condemned.

3. Never bathe when the body is cooling after perspiration.

4. A morning bathe may be taken by those who are strong and healthy before breakfast on an empty stomach.

5. The young, or those who are delicate, should bathe two or three hours after a meal, and in the forenoon, if possible.

6. The signs which forbid open-air bathing altogether are chilliness and shivering after entering the water, numbness of hands and feet, and deficient circulation generally.

7. When the body is warm, bathing may be indulged in, provided undressing is quickly accomplished, and the body is not chilled before entering the water.

8. On leaving the water, dry and dress *quickly*. Standing

about undressed, after leaving the water, is, under any circumstances, injurious.

9. Rather cut short, than prolong, the bathe. Swimmers possess the power of remaining in the water for a considerable time, in consequence of their active movements. But even in their case injury is often wrought by unduly extending the exercise. The slightest feeling of chilliness should be taken as a sign to leave the water at once.

10. Lastly, we may repeat the wholesome advice that those who experience any disagreeable symptoms after bathing—such as palpitation, giddiness, &c.—should not again enter the water without consulting a doctor.

FISH AS FOOD.

The International Fisheries Exhibition, and the growing inquiry regarding fish-supply, afford a text to the physiologist and physician, whereon they may, firstly, congratulate the public on the prospects of an increased amount of fish food; and, secondly, say something respecting the useful qualities of fish as an article of diet. It is not too much to say that fish, as a food, is greatly under-estimated, both as to its nutritive value, and as regards its relationship to other articles of diet. The common idea that fish can only be used legitimately as a mere adjunct to a meal is grossly erroneous. To such an idea, and to the want of knowledge that, as a distinct food, fish by itself ranks very high in the estimation of the scientist, we may ascribe much of the difficulty we experience in procuring a plentiful fish supply. If the public were aware of the wholesome dietetic nature of fish, they would long ago have insisted upon provision being made for its wider and cheaper sale in the metropolis and elsewhere. Once awakened to a knowledge of the fact that fish is an important and nutritious food, the people will of themselves demand and obtain facilities

for its easy and cheap purchase. One of the results of increased attention to this topic which every sanitarian must certainly hope to see, is assuredly that of giving us a more plentiful supply of the products of the deep.

It is curious to find in the records of the past, that ideas of a singular kind prevailed amongst the ancients in respect of fish as an article of food. There is no question of the extreme antiquity of the practice of fish-eating. It was very natural that the living things of the sea, which lay ready to man's hand, should form part of his daily food. But the Egyptians held peculiar opinions concerning the properties of fish. Their priests were, in particular, forbidden to eat fish; one reason which was assigned for the prohibition being, that this dietary was liable to cause leprosy. The Mosaic laws relating to food, permitted fish to be eaten. "Whatsoever hath fins and scales in the waters, in the seas, and the rivers, them shall ye eat;" but in a succeeding passage reference is made to the want of fins and scales in aquatic beings as an indication of unfitness for food. As certain fishes (*e.g.*, eels and lampreys) have no scales, and either want the definite side fins of other fishes, or have none of these fins at all, it seems tolerably clear that the serpentine form of these and other fishes must have militated somewhat against their being regarded with favour as food. It is noteworthy, that to this day, in Scotland and elsewhere, eels, which are held in high estimation in most countries, are regarded as unfit for food, or at least are rejected by the population generally from the list of edible fishes.

At the present time, whole nations are known to be fish-eaters, and to live principally, and in some cases exclusively, on fish. In the northern parts of both hemispheres we find fish-eating peoples. The Siberians grind dried fish into a powder which is used as bread, and even putrid fish is relished by some of the nomads who wander by the sea coasts. These people are, according to Dr. Pavy, "strong, healthy, and prolific. In no other class than in that of fishers do we see larger families,

handsomer women, or more robust and active men." Regarding fish as an article of diet, it may be said that it exhibits a composition allied to that of meat at large. If we compare the analyses of meat and white fish, we find them to be contrasted as follows, according to Dr. Pavy:—

	Lean Beef.	Fat Beef.	White Fish.
Nitrogenous or flesh-forming matter	19·3	14·8	18·1
Fat	3·6	29·8	2·9
Minerals....................................	5·1	4·4	1·0
Water.......................................	72·0	51·0	78·0
Total....................................	100·0	100·0	100·0

These tables show us that in its composition white fish approaches most nearly to lean beef. It contains nearly as much "flesh-forming" matter as the meat, rather less fat, less mineral matter, and an increased percentage of water. The analysis, therefore, proves that fish is essentially a complete food, in that it contains a mixture of both nitrogenous and non-nitrogenous matter, the latter being represented by the fat, minerals, and water.

Great differences exist in the relative amounts of fat and "flesh-forming" matter found in fishes. Thus, in the eel there exists 13·8 per cent. of fat, and in the salmon the fat amounts to 5·5 per cent. Another analysis of eels, deprived of all non-eatable matter, sets the fat down at nearly 24 per cent.

Viewed physiologically, we see that fish may, as the principal article of dietary, form wholesome and nutritious food. The people who feed chiefly upon fish are amongst the hardiest and most active of our kind. Eaten along with other foods, in the absence of all other kinds of flesh, no doubt can exist that fish perfectly supplies the place of ordinary butcher meat. It is less stimulating than meat, and on this account, possibly, does not satisfy the appetite so thoroughly, and this especially in the case of those who have been accustomed to a full meat

dietary. But there can be no question that fish is capable, to a very large extent, of replacing meat in a healthy dietary, and certainly, in the diet of invalids, may, judiciously used, be substituted for meat with great advantage. What is to be desired, therefore, as things are, is that white fish should be much more commonly used than at present. It might, with advantage to health, replace meat at least twice or thrice a week in the household. As a nutritious food, well cooked and tastefully prepared, fish should take rank, not as a mere adjunct to meat, but as an occasional substitute for it.

Dr. Chambers tells us that "the less salt, and the colder, the water is whence our fish comes, the better adapted it is for the table. At Gibraltar it is not hard to distinguish the mullet caught on the Atlantic side of the rock from that which lives in the Mediterranean, a warmer and more concentrated sea, so much is the advantage on the side of the former. An Icelander, dining at our house, passed by, with polite scorn, a piece of prime Scarborough cod. Seeing my surprise, he explained that no one who has tasted it at Reikiavik could bear to eat cod in England, and that it was best in the polar circle, braced up by the melting icebergs."

In the order of easy digestion, and, therefore, from the invalid's point of view, the whiting seems to take precedence of all other fishes. It has, indeed, been named "the chicken of fishes," on this account. Then succeed boiled flounders, sole, haddock, and plaice. Cod requires more digestive power, and is regarded by some authorities as more trying to digestion than is usually believed. Turbot is less easily digested than other flat fish. Rich and oily fishes (salmon, eels, herrings, sprats, pilchards, and mullet) should not be given to invalids at all.

These hints regarding the dietetic use of fish may be serviceable to many who have not come to regard the finny tribe in the light of furnishing an important food for man. As a final contribution to the subject, the following paragraph, culled

from the *Lancet*, may prove interesting in view of the economic and social value of fish as food :—"It is much to be regretted that a well-conceived idea of introducing a fish dinner once a week for paupers has failed at Canterbury. The ridiculous and unfounded prejudice which prevails among the poorer classes with respect to the nutrient value of fish has led to such an outcry among the inmates of the local workhouse that the guardians have felt compelled to abandon their sagacious project. As a matter of fact, fish would be an exceedingly advantageous addition to the diet of the working classes, as it is to that of all other orders of the people. A dinner a week of this article would be not only useful but admirable. We heartily wish the guardians had seen their way to persevere in the beneficial reform they contemplated, and upon which they had actually entered. If there had been any hope of support at Whitehall, they would probably have done so; but much as it is to be desired that fish should be popularized as an article of diet, and restored to its proper place as an integer of the common food of the people, it is to be feared that the day when light and reason will dawn upon the benighted department of Local Government is still far distant. In the articles of apprenticeship used in the City of London, in olden times, there used to be a clause providing that no master should give his apprentice salmon on more than two days a week. There is little danger of any need arising for such a covenant in the present day, but the feeling against fish which led to the introduction of this clause into the indentures of the City apprentices seems to remain."

A NEW PAIN-KILLER.

Persons, by no means of advanced age, can remember with distinctness the excitement which spread abroad when the experiments of the late Sir J. Y. Simpson with chloroform were first made known. The knowledge that painful operations might be made absolutely painless, and that misery and agony, often of indescribable kind, might be saved to suffering humanity, came like a veritable ray of light to cheer and encourage mankind. Chloroform, while not the first agent used to produce *anæsthesia*, or loss of sensation and insensibility to pain, has now been so long used in our midst that what would have appeared a medical dream not so many years ago, passes without comment to-day. "Painless surgery" is, thanks to scientific research, a reality of human life, and there are tens of thousands who have ample cause to bless the names of those to whose labours the discovery of the properties of chloroform was due.

Since chloroform came to the front, various "anæsthetics," as they are called, have from time to time been introduced to the notice of the public by physicians and chemists. It would seem as if the discovery of one valuable agent of this kind stimulated the search for other drugs and compounds which might present elements of greater safety or more universal utility than chloroform itself possesses. That agent, however, for general safety and utility, still holds the first place in the list of the chemical agents used to produce insensibility to pain. Considering the immense number of cases in which it is used week by week throughout the civilized world, and regarding the very small proportion of cases in which any untoward or fatal results accrue from its employment, there is little wonder that chloroform has held its own against more recent compounds. And when, with the experience of many years to guide us, we reflect that the administration of this substance

can now be carried out in a safe and satisfactory fashion, it can readily be seen that the risks of chloroform are relatively fewer than those of well-nigh any other great discovery. As, by efficient signalling, improved machinery and trained service, railway travelling to-day has become speedy and safe, so in the case of chloroform, the risks of administration have been reduced to a minimum. Those who would argue that because a few fatal cases—due often to preventible cause—occur in chloroform-history, this anæsthetic is therefore unsafe, exhibit as unreasonable a frame of mind as those persons who still prefer to travel by road in preference to employing the rail. No human skill can avert every danger, or at all times foresee a fatal issue, in any department of life; and as regards chloroform, we may safely assume that no safer agent has yet been employed for that chief end of the medical art—the relief of pain.

This much, by way of introducing the special subject of the present article. The first special departure from the beaten track which chloroform and its use had together mapped out, was found in the idea that it would be highly advantageous, could physicians possess the power of producing insensibility to pain in special parts of the body without necessarily inducing general unconsciousness. Thus, for example, instead of causing a patient to become insensible by the administration of chloroform, it might be, and is, found serviceable to produce a deadening of pain in a finger, in a tooth, or in the eye alone. The question, then, of the production of "local" insensibility to pain, as opposed to the total and "general" loss of consciousness, began to be mooted, and various expedients have accordingly been devised to this end. For instance, "local" insensibility may be produced by the application of intense cold to a part, or by spraying the part with certain solutions, of which ether itself presents a well-known illustration. Up to the past few months, however, it must be admitted, no method of producing this local effect was free from objection

of one kind or another. Accordingly, the announcement that a new "local," and apparently effective and safe, "pain-killer," had been discovered was hailed with gratification by medical men, while it need hardly be added that the subject is one also in which the public are well entitled to feel a deep and lasting interest.

The new "pain-killer" is named *Hydrochlorate of Cocaine.* It is the active principle or "alkaloid" of the leaves of the coca-plant, which, as our readers know, is celebrated for its virtues in the way of stimulating the flagging energies, and of imparting powers of endurance. The cocaine compound was known to science as early as 1853, but it is only within the past few months that its properties of locally producing insensibility to pain have been discovered. To Dr. Koller, of Vienna, science is indebted for the discovery in question. The drug appears to have been first used in operations on the eyes. A two-per-cent solution of cocaine was used. Two drops of this fluid were placed in the eye of a patient at Heidelberg. In ten minutes it became evident that the sensitiveness of the eye was much reduced. Two drops were again placed in the eye, and in ten minutes more the eye was as completely insensible to touch and pain as if its possessor had been dead. The eye itself was tested in various fashions by way of proving the effect of the cocaine to be a real phenomenon. As a result, the patient declared that he felt no pain or unpleasant sensation whatever during the severe manipulations to which the normally highly-sensitive eye was subjected. The other eye, which had not been treated with cocaine, remained in a perfectly natural condition, and evinced its usual sensitiveness. It became apparent, therefore, that in cocaine physicians had been provided with an agent likely to prove of high value in the surgical treatment of many of the ailments to which flesh is heir.

Naturally, further and more extensive experiments were required to establish the value of the new compound. It may

be said on this point, that what is known regarding its effects, only serve to substantiate the idea that a new drug likely to prove of high value in relieving pain has appeared on the horizon of medical science. So great is the demand for cocaine, that, as we write, it is selling at 2*s.* 6*d.* per grain. Mr. Henry Power has testified to its great value in operations on the eye. It acts in producing complete loss of sensation in the eye in a few minutes. Mr. Power uses a solution of 4 per cent. strength. A child was operated on for squint—always a painful and delicate operation, and more especially so in the case of children—and no pain was felt; the child merely "whimpered a little" at the sight of the surgeon's scissors. Mr. Power makes a highly important remark, when he adds that cocaine does not, when properly used, seem to produce any disagreeable after-effects.

In another case, a medical man gives his experience of the value of cocaine in his own person. He had to submit to a very painful operation connected with the delicate lining membrane of the inner nostril. The surface was painted with a 20 per cent. solution of the drug—the stronger solution being adapted for such cases—when, to quote the patient's own words, "the effect was marvellous," and the operation, which before had caused excruciating agony, was performed in comfort and without pain. Dr. Semon, who operated in the case just named, has also shown that cocaine was of the utmost service to him in operating for the removal of a growth from within the organ of voice or larynx. Any one may understand how irritable and tender this region is in health, when he reflects on the spasmodic cough which ensues when even the smallest bread-crumb has intruded itself into the organ of voice. Hence Dr. Semon's relief to find that, after applying cocaine to the organ in question, he was able to perform a delicate operation easily and quickly, and without the patient experiencing pain.

It is also probable that the virtues of cocaine will not end

with its applications as an outward agent for the abolition of pain. The relief of pain through its internal administration is also now being successfully carried out. In half-grain doses it has been prescribed for sleeplessness; and the drug is likely therefore to grow into use, in the hands of medical men, as a useful sedative or soothing agent. There seems little doubt that in cocaine a new agent has been found which will expedite the cure of many diseases through its powers of producing local painlessness, and of thus bracing suffering humanity for ordeals which are often terrible enough in themselves, even when all pain has been abolished.

THE "SIX-FINGERED" CONDITION AND ITS INHERITANCE.

The idea that a state which begins as a departure from the normal and usual history of man, may, in the course of time, appear by inheritance as a natural feature of the race, is fostered by the facts of physiology and medicine alike. The disease which, in one case, kills off the individuals who suffer, in another case adapts itself to the conditions of human life; whilst the human constitution may in turn become adapted to the disease and survive under its attack and reign. Such a condition of matters is illustrated by the case of the negro race. If Professor Klebs' theory (see succeeding article) be regarded as in any sense trustworthy, it would seem that the dark colour of the race has originated as a product, if not of actual disease, at least of unusual, and physiologically erratic, action. Disease, like other and healthy conditions, may thus inaugurate transformations and changes within the human estate. Man's destiny in this light and his physical transformations, as well as his mental qualities, are seen to be moulded, not always by the normal actions, but occasionally by the

conditions which produce the physical backsliding we are accustomed to call "disease."

Amongst the unusual conditions which make their appearance in human life, are certain interesting features connected with the development on hands and feet of extra digits. These "supernumerary fingers and toes," as they are termed, are by no means uncommon, and the family history of the individuals who exhibit the peculiarities in question, becomes remarkably interesting when considered from a scientific point of view. The question of "inheritance" presents in such cases a study involving much that is both curious and important. In the light of the theory of evolution, or even apart from that idea of living nature, and merely as a study in human variation, these "six-fingered" individuals form subjects which become exceedingly attractive to the man of science.

A classic example of the "six-fingered" variation and its perpetuation is found in the case of Gratio Kelleia, a Maltese man, whose history is detailed by Réaumur, the famous naturalist, in his work entitled "L'Art de faire éclore les Poulets." Gratio Kelleia's parents possessed perfectly natural and normal hands and feet; but their son was born with six fingers on each hand and six toes on each foot. The toes were scarcely so well formed as were the fingers. There is no possibility of accounting for the sudden appearance, so to speak, of this six-fingered individual. History is silent regarding his ancestry. But that it is perfectly possible for variations to appear in high and low life alike, without previous warning of their coming, is a fact well known to every student of natural history. Nature sometimes does "take a leap," and send an individual off at a tangent on the way of development.

In due time Gratio Kelleia married. His wife's hands and feet were perfectly natural in every respect. To this couple were born four children—three sons, respectively named in order of age, Salvator, George, and André, and a girl named

Marie. In this family circle the father's variation from the normal type of hand and foot appeared perpetuated in a singularly clear manner. Salvator, the eldest son, had six fingers and six toes on each hand and foot, like his father. George and André did not develop any extra digits. They resembled the mother, but the hands and feet of George were slightly deformed. Marie had five fingers and five toes like the mother, but her thumbs were deformed. Now, in this first generation the six-fingered and six-toed variation thus declared itself with plainness and certainty. In one case, the variation was produced in all its exactitude. In the second son and in the daughter there was indicated a tendency towards the reproduction of the deformity, while in only one case—that of André—was there a perfect representation of the normal state.

But the family history of the Kelleias was traced to the second generation; and here more interesting details present themselves to view. The sons married wives possessing the natural number of fingers and toes, and the daughter espoused a husband who was likewise provided with normal hands and feet. Taking Salvator's family first, we find four children born, of whom three showed the six fingers and six toes of their grandfather and father, while the youngest child possessed the natural hands and feet of grandmother and mother.

The family of George consisted of four children. Of these the two eldest (girls) possessed each the six fingers and toes of the grandfather; the third child (also a girl) possessed, curiously enough, six fingers on each hand, and six toes on the right foot, but five toes on the left; while the youngest child (a boy) was perfectly normal, and resembled his mother completely. André had a numerous family, all of whom were perfectly natural in respect of their extremities. Of the four children of Marie, her eldest (a boy) showed the six fingers and six toes of his grandfather, the other three children exhibiting no such peculiarity.

This history, therefore, shows us that the variation which began with Gratio Kelleia, and which was repeated with increased force in his children, became intensified in the next generation. In Salvator's case, the abnormality was naturally represented in its fullest form; but even in the case of the daughter Marie, who started life with thumbs merely deformed and who married a husband possessing normal hands and feet, the six-fingered variety came prominently enough to the front. There can be no question, considering the strength and potency of the variation, even when labouring under the disadvantage of mingling strongly with normal blood, that if the individuals whose history is thus detailed had mated with six-fingered partners, the increase in the six-fingered offspring would have been most marked, while the abnormality itself would have appeared of singularly pure and unmixed nature.

In the "Guy's Hospital Reports" (Vol. XXV.), Mr. R. Clement Lucas gives an exceedingly interesting account of the tendency towards the perpetuation, by inheritance, of the six-fingered variation. In the family whose history Mr. Lucas details, so well-known was the tendency to the perpetuation of the six-fingered and six-toed variation, that when an infant was added to the family the father's "first thought was to examine its feet and hands." The variation in question appears to have begun in the great-grandmother of the family. It occurred in no less than 24 persons out of a total of 80 descendants, or 30 per cent. of those descended from this lady; and Mr. Lucas adds that considering the "new blood" which has been infused into the family circle by marriage, "the persistency with which this tendency asserts itself is very remarkable."

The grandmother (on the mother's side) had a family of eight, five of whom (two sons and three daughters) were born with abnormal hands and feet. Her eldest son suffered from no deformity, but three of his children (out of the total of nine) were affected. The second son, a man over six feet in height, had six toes on each foot. He had seven children, three of

whom were affected. The third son, who had normal hands and feet, had also seven children, and all seven escaped deformity. This latter fact, curiously enough, parallels the case of André Kelleia already noted. The fourth son, who had no family, possessed six toes on each foot, and in addition suffered from harelip. The eldest daughter was six-toed; and to her were born four sons and a daughter. Two sons (first and fourth) had extra toes, while the remaining children were normal. The second daughter's peculiarity consisted of an extra finger on each hand. She had ten children, six sons and four daughters, and out of the number only two were deformed, a son (the second child) and a daughter, who ranked fifth in number. The third daughter of this family was the grandmother of Mr. Lucas's patients. She possessed an extra finger on each hand. The youngest daughter showed no deformity. She remained unmarried.

Coming now to the generations succeeding this first, Mr. Lucas tells us that the grandmother in question (the third daughter above-mentioned) had seven children, five sons and two daughters. The eldest, a daughter, was born with one extra finger. She had no family. The second, a son, had six toes on one foot, and seven on the other; with five fingers and a thumb on each hand. To him were born five children, four sons and a daughter. Three of the sons (the two elder and the youngest) had extra digits. The third son, born normal, had twelve children, all likewise normal. The fourth child, a daughter, was born normal; she had no children.

The fifth child was the father of Mr. Lucas's patients. He had six toes on one foot, and seven toes on the other, the inner toes were webbed; and five fingers and a thumb were developed on one hand. Here, the abnormality bred strongly. His eldest son had a cleft palate and harelip, and a web between the great toe and the next, in each foot. His second, third, and fourth children (two girls and a boy), escaped deformity; but

the youngest son was born with six fingers on each hand, six toes on each foot, and a web between all the toes.

The sixth son (uncle to the children last noted) was born normal, and had three children, all normal likewise; and the same natural condition was seen in the seventh child (a son), whose daughter was also born without deformity.

The cleft palate and harelip mentioned above were foreshadowed, as Mr. Lucas points out, in the harelip which occurred, as noted, in a great-uncle.

These cases of human variation become interesting from the point of view which regards man as living under conditions of life which materially affect his physical well-being; and they further show, in an instructive fashion, how powerfully the laws of inheritance operate, when once an initial stage or starting-point, in health and disease alike, has been developed.

DISEASE AND THE TRANSFORMATIONS OF MAN.

All science is practically agreed that living beings have come to their present forms and condition through long ages of variation and change. New species are produced through the modification of the old. Repeated departures from old types can be traced in the fossil history of animals and plants, and the worlds of life are thus seen to owe their many-hued aspects to the alterations which food, climate, and other conditions have produced in the species of the past. This is the main contention of that theory of nature to which the general name of "Evolution" or "Development" has been applied. The variations of animals and plants have produced new races, and these races, varying in their turn, give rise to forms which so far depart from the type with which the process started that

they appear as a new species. The zoologist and botanist can point to countless examples of variation in living beings; and that such has been nature's way in the past history of life is abundantly proved by many considerations. Thus the development of animals and plants affords abundant evidence of the fact that living species to-day have been made what they are by the alteration, for better or for worse, of pre-existing forms of life. The frog begins its life as a fish—the well-known tadpole—it breathes by gills and possesses the heart of a fish. But as time passes, it develops onwards into a form resembling that of the newt or eft, and finally discarding its tail, and developing lungs, it leaves the water and becomes the air-breathing frog. The only explanation of this curious life-history seems to be that which assumes that the frog is the last term in a development, which began when some far-back fish-ancestor developed lungs in addition to its gills, and which continued as this eft-like form in turn assumed the frog-characters. The history of a frog is, in fact, a panoramic picture of the development of its race.

In addition to the evidence of development, we find the facts of geology, the distribution of life on the earth, the presence of rudimentary organs in animals and plants, the items of degeneration, &c., to aid in establishing this great idea or doctrine of evolution. Readers who wish for a full statement of the evidence in question, will find such formulated and illustrated in the writer's "Chapters on Evolution" (Chatto & Windus). In the present instance, we have cited the general facts of development merely by way of preface to what promises to be a study of much practical interest in connection with human health and welfare. Man's concerns do not lie outside the scope of development, although they are no doubt largely modified by the circumstances of his life and habits. In this connection, recent studies in the work of *disease*, as producing changes and variations in human beings, become of high value. Naturalists, as we have seen, tell us

that such circumstances as food, climate, &c., work changes in living forms; and of the truth of this axiom, which credits outward causes with affecting living beings, no one may entertain a doubt. But if the opinion of a distinguished scientist, Professor Klebs (of Zurich), may be relied upon, it would seem probable that we must credit internal or inside causes with at least a share of the work of producing variation in living beings. And as regards man, there seems every reason to believe that in this work, disease has played a part hitherto greatly overlooked, but not on that account the less to be attentively studied.

The law that "like begets like" (scientifically known as "the law of *heredity*") is, of course, popularly understood and demonstrated as an essential power and factor in causing living beings to resemble their parents. But when change or alteration has been produced in one generation, this law, for the time being overruled, again asserts its sway and reproduces the changed state, as formerly it begot the natural structure. The latter observation, as is well known, holds highly true of diseased conditions. We know, only too well, how departures from health are transmitted to offspring, and how consumption, scrofula, epilepsy, insanity, and even the tendency to intemperance, are "bred in the bone," and reappear, often with fatal exactitude, in the generations succeeding the affected parents. Six-fingered parents, as we have seen, exhibit their deformities repeated in their children. Mr. Clement Lucas tell us (Guy's Hospital Reports, Vol. XXV.) that he has been able to trace even "a crooked little finger through three generations." We may thus conceive that in due time, such repeated and transmitted peculiarities, mental and bodily, may come to represent part and parcel of the history of the individuals included within the limits of the family, and serious departures from the natural and normal type may thus be engendered.

Professor Klebs has directed special attention to the influence

of the condition called *cretinism* on human variation and change. The *cretins* are found on the highlands of Central Europe—in Switzerland, Bavaria, and Austria. It is in these districts that the disease known as *goître* exists. This malady, believed to be produced by over-hardness of the drinking-water, appears as an enlargement of a gland (*thyroid gland*) in the neck, and causes a terrible deformity of that region of the body. Cretinism is found associated with goître. The subjects of this latter condition live practically in a state of bodily and mental degeneration. They are often idiotic in character, and their bodily frames are stunted and dwarfed in a remarkable manner. Professor Klebs, referring to the results of this transmitted degeneracy of bone and body generally, inclines to believe that a dwarfed race of human beings may possibly have arisen in the past from this source of variation. In such places on the European Continent as Salzburg, Puizgau, and Pongau, the natives are said to appear in striking contrast (owing to the influence of cretinism) in bodily size when compared with such of their kith and kin as have been compelled to quit these districts and settle in healthier localities.

In mountainous districts, however, cases of the opposite condition, namely, of *excessive growth*, may also be met with. Inhabitants of mountainous districts are said to present great irregularity in size, and, on the whole, to exhibit a shorter stature than the dwellers in the lowlands. It is probable, of course, that this decrease of stature may depend on causes connected with a life spent at a high level, and with the special peculiarities of breathing, &c., which a mountain life entails. Professor Klebs thinks that the extreme stature occasionally seen is produced by diseased, or, at least, by unusual and unnatural causes. At Elm, we are told, a remarkable instance occurred, in which a man began to grow at the late age of thirty-six, the increase continuing till his death, six years later. In the same locality such cases are not

unknown. Giant-growth in mountainous regions is thus a singular fact. It has been suggested that there exists some connection between this growth and the nature of the soil. The conditions, however, which thus seem to stimulate nutrition and bodily increase are, as yet, unknown. All explanations of these curious histories are, at present, to be found only in the domain of pure conjecture.

Another peculiarity, to which the studies of Professor Klebs have directed attention, is the development of colour in the skin under certain diseased conditions. It is a well-known fact of medicine, that "bronzing" of the skin is found associated with disease of certain organs, lying one above each kidney, and named "suprarenal bodies." The functions of these bodies are unknown; but they are believed, like the spleen and other glands, to be connected with the elaboration of the blood. Dr. Addison first noted that the "bronzing" of the skin, most marked on face, neck, arms, &c., appeared to be a result of disease of the "suprarenal bodies." His own words were—speaking of one case,—"that, but for the features, the patient might have been mistaken for a mulatto." Now, a second curious fact has been noted, namely, that these organs, which appear to be centres of colour-production in the body, possess their central parts coloured or "pigmented" in the dark races of mankind, and in dark individuals belonging to fair races. Hence it has been inferred that changes of colour in man, due to various causes, and affecting hair and skin, may take their origin from diseased or unnatural conditions affecting these "suprarenal bodies."

A step further in the direction of probabilities founded on a study of the conditions of human life, lands us, according to Professor Klebs, in a curious field of speculation. What may have begun as a simple disease, by inheritance, may have come to be propagated as a natural character of a race. The Negro race, according to this view, may possibly have sprung from a white race. Diseased changes, set up in the colour-organs of a

white race, may have resulted in the production of a coloured or dark race. It is well known that *malarious* conditions—that is to say, the influences derived from swamps and morasses—affect the spleen and all ed glands, and produce diseased states, of which "agu s a familiar example. The negroes have had their origin, according to Klebs, in swampy districts; and the production of a dark race is thus viewed as a matter of diseased or abnormal action. Considering also that the evil influences of the swamps have been proved to be due to a *bacillus* or living germ, it would seem as though the "germ theory" might be destined to play a part in explaining the evolution of mankind. Whether or not Professor Klebs' views are correct, time alone can show. But there is a latent probability in their terms which should commend them to the criticism of medical science. It will assuredly increase our sense of the marvellous in the history of living beings, if disease should be proved to be a more potent factor than we have hitherto deemed it in inducing changes and variations in the world of life.

CAN CONSUMPTION BE COMMUNICATED?

The old idea of consumption was that of a wasting disease, which had its representative condition in other parts and organs of the body. "Tuberculosis" is the name given to the common condition or disease of which consumption (or *phthisis* as it is called—pronounced "*thysis*") is the special phase or form attacking the lung. In examining a case of consumption, we note, of course, the wasting to which the body has been subjected. In the first stage deposits of what has been called "tubercle" form in the lung. This is the disease-material. Later on, the tubercles grow softer, break down, and form "cavities"

or spaces in the lung, thus destroying the lung-tissue. The organs of breathing are, in fact, attacked by a peculiar disease which destroys their substance to a greater or less extent, and which produces in the body generally the signs and symptoms of the wasting we know to accompany consumption as a marked feature of its course. Within the last few years, however, a marked change has passed over the field of medical opinion regarding consumption and its cause. The information which has been acquired concerning this disease becomes of vast public importance when we reflect that upon a knowledge of what consumption really is, the people here, as elsewhere, may make health-capital out of "saving knowledge," and may be led to prevent disease by an exercise of such knowledge.

Not so very long ago, it was discovered that, associated with the masses of "tubercle" matter found in the lungs in consumptive cases, certain microscopic particles, called *bacilli*, were continually found. It was Dr. Koch, a German physician, who discovered the *bacillus* of tubercle. He found, in other words, associated with the matter, formerly regarded as the essential element in and cause of consumption, microscopic bodies or germs, rod-like in form, and recognizable as related to other bodies found in close connection with various diseases. These rod-like *bacilli* vary in size. Their average diameter is about half that of one of the red globules of our blood—namely, about one-sixth thousandth part of an inch. Koch, discovering these *bacilli* in consumptive lungs, was naturally led to ask, "Are the *bacilli* the cause, or merely the result, of the disease?" The reply to this all-important question could only be determined by an appeal to nature herself; and there is only one way in which important truth can be elicited in such an appeal—namely, by experiment. Koch found that if he took some of the *bacilli* from a consumptive lung, and inoculated (that is, introduced into the blood) animals, such as rabbits and guinea-pigs, with these particles, he could produce in due time in these animals all the features of the dread disease. The animals lost flesh,

became emaciated, and finally died; their bodies on examination revealing the characteristic features of the tubercle-disease with which they had been inoculated.

These experiments would seem to confirm what is believed by some of the most accurate observers in England and abroad, that the *bacilli* are the cause of consumption. "What are the *bacilli?*" is a question which may be answered by saying that they are microscopic forms of life—probably of plant-nature. They breed as do the lowest plants. They grow from minute bodies called "spores," and apparently find as natural a habitation within the body as do certain of their neighbours—such as the *fungi* that produce skin diseases—on the outside of our frames. There appear to be many varieties of these *bacilli.* Some are certainly harmless in their characters. Others, as we have seen, are invested with the power of producing disease. The splenic fever or *charbon* of cattle and sheep is caused by a *bacillus;* and it is probable that most of the "fevers" that afflict us are produced each by its own and special form of lower life. The latest science has thus revealed to us fields of life existing and flourishing within existence of a higher type. The modern theory of infectious diseases is that which contends that such ailments are caused by living particles, and not by dead or lifeless matter. The fever is merely "the outward and visible sign" of the growth, within our frames, of lower organisms which have seized upon our bodies, and have found therein appropriate conditions for successful multiplication.

The important question, "Is consumption an infectious disease?" has to be answered in face of the foregoing facts dealing with the nature of the ailment. There has long existed a belief in the popular mind—founded, no doubt, on that untrained experience which is in itself a powerful teacher of facts—that consumption is "catching." People have long possessed the idea that it is not a good or wise practice to permit the consumptive and the healthy to sleep together, and,

as we shall see, there is apparently every justification for this idea. If the *bacilli* are the causes of consumptive disease, and if, as experiment proves, they are coughed up from the lungs of patients, and pass out in the breath, it is by no means a far-fetched supposition that they may be inhaled by persons whose "predisposition" (or bodily tendency) or health, is such as to adapt them to become infected. If, as we thoroughly believe, consumption *is* infectious in this sense, the *bacilli* or microscopic living particles, passing from sick lungs to other lungs, susceptible in one way or another to their influence, constitute the means of infection.

But very recently there have been laid before the medical profession an interesting series of observations connected with the communicability of consumption. "The Collective Investigation Record" of the *British Medical Association* has supplied us with a variety of cases illustrating this latter tendency. Leaving out doubtful cases, and those in which no evidence tending, one way or the other, for the infectious nature of the disease has been noted, there remain a list of cases, recorded by medical men, in which the evidence for the infectious nature of consumption is singularly complete.

In 119 cases, the disease is recorded as having been transmitted from husband to wife, and in 69 from wife to husband; while in 130 of these cases, it is stated, there was no family tendency to the disease in the partner to whom the disease was conveyed. In 32 cases, there was infection between brothers and sisters, and *vice versâ*. What, however, are we to think of strange cases such as the following?—A servant nurses her master and mistress; the former contracting consumption from his wife, and the servant dying in turn of the disease. A dressmaker, aged forty-eight, "living in rather a lonely cottage," had three girls, apprentices, *not related to one another*. These girls resided in turn, for a week at a time, with the mistress, occupying the same bed as the latter. During their apprenticeship, the mistress died of consumption; and, *in less than two*

years afterwards, all three apprentices died of consumption. There was no family tendency to the disease in the history of any of the girls. A healthy servant girl, aged nineteen, slept for several months with a fellow-servant. The latter left her situation on developing consumptive symptoms; and the healthy girl ultimately developed consumption, and died of the disease—no other member of her family having been affected before or since. A child, with an absolutely healthy family history, was nursed by a consumptive servant. The child contracted the disease, which, as might have been expected, ran a rapid course, and ended fatally.

It is needless to prolong the list of such cases, which, in their plain, unvarnished statement of facts, taken along with the scientific history of the disease, supply a clearly affirmative answer to the question which heads this article. That which is of supreme importance, as a practical deduction from the latest facts of science, is the health knowledge we acquire from a study of consumption and its history. We may sum up our health-maxims concerning consumption as follows:—

1. In any case of chest trouble of consumptive nature, it is highly improper for the patient to occupy the same room with another person.

2. This holds especially true of the case of the young, who should be carefully supervised in their relations to possible sources of danger from nurses and others.

3. The ventilation (and disinfection) of the rooms occupied by consumptives should be continually practised. The disinfection of all matters brought up from the lungs should also be thoroughly carried out.

4. The high importance of maintaining the *general health* is also indicated; for it may be laid down as a general rule that consumption (and all other diseases, in fact) is more likely to attack us when our health is below par, than when we are in good health. A low condition of the general health is, in fact, the borderland leading to many diseases.

MEAT TEAS.

The topic of "meat teas" does not at first sight appear to be an interesting or important one; but considering the common nature of the practice of combining dinner and tea, it seems worth while to direct attention to a recent deliverance on the subject. The habit of uniting dinner and tea to form the familiar "high tea," is greatly in force with many, who, unable to dine solidly in the middle of the day or in the afternoon-interval of the day, depend for sustenance upon the meal in question as a chief means of support at the close of the day's labours. Physicians and physiologists have always condemned "meat teas," on the plain ground that the combination is one difficult of digestion, and opposed to what may be called the natural chemistry of food assimilation. By medical men, the warning "avoid meat teas" has over and over again been given. It is satisfactory to find that Dr. James Fraser, in the *Edinburgh Chirurgical and Pathological Journal*, has been able experimentally to show that the warnings against the popular "high tea" may be founded on sure and scientific grounds.

To rightly understand the position assumed in such an investigation, we must remind our readers that amongst the chemical principles composing our bodies, and demanded by our bodies in the foods we give them, the *nitrogenous* or *albuminous* substances form a most important group. Albumen, represented by white of egg and allied substances (including the living matter, or *protoplasm*, of our frames), forms at once the type of these nitrogenous compounds, and of the chief "flesh-forming," or, as they are also called, "nitrogenous" foods. Such foods consist of four elements—to wit, carbon, hydrogen, oxygen, and nitrogen. Dr. Pavy, in his classic work on foods and digestion, remarks that all bodily work is associated with the consumption, elaboration, and breaking down of nitro-

genous foods. Nitrogen appears to be that element in our food on which depends the due regulation, substance, and energy of the most living parts of our bodies. Although plants possess nitrogenous compounds as part of their chemical belongings, and although some plants feed, like animals, on a dietary which includes a large amount of nitrogen, yet the vegetable world, on the whole, does not so markedly depend on nitrogenous foods for support as does the animal creation.

The food principles which contain nitrogen are represented by such substances as the *casein* of milk and cheese, the *gelatin* of bones, the *fibrin* of blood, the *gluten* of flour, &c., in addition to white of egg (or ordinary *albumen*) wherever found. Albumen itself, derived from animals or plants, is thus, in plain language, the representative of a family of substances which, though not capable of supporting our frames by themselves, nevertheless constitute the chief group of foods demanded for our support. The second class of our foods is, in fact, called the *Non-nitrogenous* division, because the element nitrogen does not enter into the composition of this group. In the latter division we include the starches and sugars, the fats and oils, water, and mineral matters. Starches and sugars, together with fats and oils, consist of carbon, hydrogen, and oxygen, combined in different proportions ; water consists of hydrogen and oxygen alone ; and the minerals (lime, potash, soda, iron, &c.) necessary for the support of life possess, of course, their own and characteristic composition.

When we take such a fluid as beef-tea or beef-essence we receive a substance whereof the nutritive part is chiefly albuminous or nitrogenous in its nature. Such fluids (and the same remark holds good of flesh itself) consist besides, of water, minerals, and fats, but it is to the nitrogenous parts of them that we look for the pure nutritive results involved in their digestion. Hence the interesting question raised by Dr. Fraser in his recent communication may be practically stated as involving the question : " What are the effects of the

common beverages of life on the albuminous substances which, in the varied forms of meat, fish, &c., we habitually receive?" The common beverages in question are, of course, primarily, tea and coffee, and to the list must be added cocoa and cocoatina. In tea and coffee, as is generally known, there is, practically, no nitrogenous matter, whereas cocoa does contain such material. Tea, coffee, and cocoa, however, owe their stimulating properties to the presence in each case of a special principle, called *theine* in tea, *caffein* in coffee, and *theobromine* in cocoa. It may be said, indeed, that it is for the effect of these substances on the body that we value these beverages. In their own way, they are highly important additions to our list of food resources; and it is, therefore, of the utmost importance that we should know how to utilize them to the fullest advantage, and to avoid their employment in any way or fashion by which their utility is impaired.

Dr Fraser tells us broadly that tea, coffee, and cocoa all retard and interfere with the digestion of albuminous or nitrogenous substances, except in four cases. He finds, for example, experimentally, on the favourable side of the "meat tea" question, that coffee does not appear to delay the digestion of ham, and that the digestion of white of egg is not interfered with by this beverage. Again, he informs us that the nitrogenous parts of that highly-important article of diet, fish, digest amicably and peaceably enough along with both cocoa itself and with cocoatina. The practical outcome of these observations would, therefore, seem to consist in the remark that the ordinary breakfast habits of the nation in taking fish along with cocoa, or ham and egg with coffee, are justifiable from a physiological and chemical stand-point. The presence of salt in meat, curiously enough, was found to prevent digestive delay, in the case of meat and the common beverages above noted being taken together. Again, concerning the degree in which the beverages act on foods which may be taken with them, there seems to be certain important variations. Cocoa is

found to retard digestion most; tea comes next in order; while coffee is the least injurious in this respect. No less interesting is the observation, that the addition of cream and sugar seems to increase the injurious effects of cocoa on digestion, while such addition reduces such action in the case of tea. The latter beverage is credited with causing flatulence, and, as physicians know only too well, is responsible for a vast deal of the digestive trouble which stalks abroad amongst the working-classes especially.

The practical lessons deducible from Dr. Fraser's experiments are of extreme value. In the first place, they teach us broadly that "meat teas" are a mistake, and that those who indulge in these meals are liable to qualify themselves for indigestion produced by the plain chemical considerations already detailed. In the second place, we learn that fresh meat especially should never be taken along with tea, coffee, or cocoa, seeing that the influence of these beverages on this latter description of food is highly marked and of distinctly injurious character, in so far as healthy digestion is concerned. A third point of importance deserves to be noted, however, in the fact that the practice of taking coffee or tea immediately after dinner is probably deleterious, or at least, can serve no good end in expediting digestion—the practice in question, it might be added, however, has probably a more intimate relation to the correction of the effects of wine, than to the stimulation of digestion. A fourth piece of advice may, lastly, be tendered to the effect that we should bear in mind that tea, coffee, and cocoa possess their own value and special use as beverages. Tea and coffee are mere adjuncts to food—they are not foods in themselves. They may be taken in moderation by those who are well nourished otherwise, but should never be drunk along with meat. Cocoa (with milk and bread) constitutes of itself a nutritious dietary; seeing that it contains nitrogenous matter of its own. The great lesson, however, to be borne in

mind is, that we should not associate the beverages in question with meat, and with the more solid meals of the day.

THE BALANCE OF POWER IN THE HUMAN BODY.

A TOPIC of more than usual interest to all students of health and physiology is that included in the consideration of the means which Dame Nature employs on her own account in combating the effects of disease, and in inducing a return to the natural state of the body after disturbance of its duties or alteration of its structure. As in the body political, so in the body natural, there is a "balance of power." When the pendulum of action has swung to the side of disease, there is a tendency to bring its motion back to a state of equilibrium. This tendency in the living body has long attracted the notice of the man of science. He has called it the *vis medicatrix naturæ*—"the healing power of nature," and he has always laid his account for its operation in the cure of disease. In opposition to the quack idea that disease is a mysterious something which may be driven out of the body by drugs or other treatment, the true physician has always recognized that the best of his endeavours are those which favour and encourage the "healing power," the operation of which evinces nature's anxiety to overcome the principle of the ailment which affects the frame. *Je le pensay et Dieu le guarit*—"I dressed the wound and God healed it"—was a saying of Ambrose Paré, the great French surgeon, and there is no question that this idea, in many other modes of expression, has always been present in the minds of physicians and surgeons of all ages.

It is difficult to see how the facts of illness could be otherwise interpreted. In many cases the "healing power of nature" is the sole means of cure. The living body often rights itself without drugs, or, as the cynic has expressed it,

"in spite of the doctor's efforts." We still know so little of the action of many drugs that, but for our recognition that we only help nature, as it were, in her healing work, medicine might well be ranked as an empirical or rule-of-thumb science after all. The scratch on the finger heals because it is part and parcel of nature's method and constitution that "repairs are speedily executed," to quote the shoemaker's announcement. In injuries or ailments of the gravest nature the same power may be witnessed. What has been called the "spontaneous cure" of injuries in diseases, is only another fashion of recognizing this fact. The injured finger or limb, left to itself, may be cast off. The nail, injured beyond repair, is similarly thrust forth from the tissues. We see the same feature in certain diseases of bones. Dead portions are cast off from a bone, and new bone is made to replace the loss. Numberless instances might be multiplied of this interesting feature of the living economy; and the recognition of such a "healing power" really lies at the root of the practice of the physician and surgeon alike.

There exist, however, certain less familiar, but still typical examples of this power, and it is to some of these instances of natural cure that our attention may now be directed. Dr. Mitchell Bruce has recently drawn attention to this topic, and has brought anew under scientific notice, the value of such facts in the study of diseases and their cure. A notable example of this "balance of power" in the living body is to be found in certain ailments in which the heart participates.

The heart is a hollow muscle. It is divided into two sides—right and left. Each side is again divided into two compartments; an upper and smaller, the *auricle*, and a larger and lower, the *ventricle*. The right ventricle is perpetually driving impure blood to the lungs for purification, while the left ventricle is occupied in sending pure blood outwards through the arteries to the body.

It is obvious that if any obstruction exists to the outflow of

blood, say, from the left ventricle, the work of this chamber of the heart must become singularly impeded. Now, such obstructions do occur in the history of the heart and its work. But for the power of nature to balance and adjust the disturbed mechanism, life would be terminated. There is, however, in such a case, a compensation brought about which is alike familiar to the physician and interesting to the student of health science. The obstruction itself may defy natural means of cure. It cannot be got rid of, and it remains to represent the actual disease. It is the heart, or rather the left ventricle itself, which becomes the subject of compensation. With an obstruction to its work, the ventricle receives a call to the exercise of increased energy. Its muscular substance thus exercised, grows and increases in size, so that it is enabled more powerfully to force blood outwards into the blood-vessel at the entrance to which the obstruction exists. In due time, if the cause of the increased work is not removed, the left ventricle of the heart becomes permanently thickened; and, in this state, the heart may discharge its functions uninterruptedly through a long series of years.

We see the same reply of nature to the demands which excessive use or exercise make upon the muscles. The blacksmith's arm, and the ballet-dancer's legs, are examples of similar or analogous achievements in the way of overcoming difficulties which the mode of life or the inroads of disease may bring into the field of being.

Once started on the search for illustrations of this interesting work of nature, we find no difficulty in discovering other examples of the power of the living body both to throw off disease, and to accommodate itself to circumstances which it may be powerless to modify or override. The heart, again, supplies a typical illustration of natural relief in certain states which, but for the existence of means of modifying them, might prove fatal to the work of the organ. The nervous supply of the heart includes nerves which stimulate its work,

and others which curb or check its action. In addition, there exists a special nerve whose duty it is to procure relief when any sudden strain is put upon the work of the organ. For example, when, say, there is a tendency to obstruction in the left side of the heart, we have seen that this may be relieved by the heart's muscular substance acquiring an increased development. But in cases of temporary obstruction, when the work of the left side of the heart is impeded, and when failure of the organ in the attempt to carry out its duties is imminent, provision is made for its natural relief. In climbing, or in rapidly ascending stairs, for example, there is a tendency to engorgement of the left ventricle of the heart, and the well-known breathlessness and tendency to faintness, which ensue in cases where the exercise has been too energetically pursued, are simply due to the extra labour which has been thrust on the heart, and especially on its left side.

How, then, is this tension relieved? The physiologist replies, "By a special arrangement of the nervous mechanism of the heart." Included in these arrangements, we find a special branch of that important nerve called the *vagus*. This branch conveys impressions *from* the heart to the particular nervous centre which controls the affairs of that organ. The nerve in question resembles a telegraph wire, employed to convey messages in one direction only—namely, from the heart to its central office, or directing-bureau, as it were. When the heart's functions are, therefore, disturbed, or when even death may appear imminent from the distension and paralysis of the left side of the organ, an impulse—a veritable call for help, in fact—is transmitted along the nerve in question. The message received by the special controlling nerve-centre for the heart is, in turn, despatched to another centre, or office, which controls the movements of the arteries or blood-vessels connected with the left side of the heart. This second message has the effect of relaxing the arteries; they are thus capable of readily receiving the blood which the distended left side of the

heart is anxious to propel into them, and the strain on that organ is at once relieved.

The knowledge of this interesting mechanism, it may be added, led to the discovery that the substance called nitrate of amyl was to be relied upon as a remedy in these cases. As this substance, in reality, acts by expanding and dilating the arteries, we see how the physician in applying such a remedy has, in reality, been founding his practice on the principles of this natural "balance of power," which everywhere exists in the living frame.

NATURE'S MODES OF CURE.

The natural relief of many conditions which are apt of themselves to prove dangerous or even fatal to life having been illustrated in our last paper, we may now proceed to note the probable origin and meaning of the natural cure of ailments—that is, of the curious "healing power of nature," to which allusion has been made. In the case of the heart, as shown in our last article, there exists a regulating mechanism, which seems as if it were intended to forestall the occurrence of strain and accident in the central organ of the circulation. The overcharged, overdistended, and overstrained heart is enabled, through its nervous mechanism, to apply for and obtain relief. It is an extension of this same tendency in living beings which apparently gives us the natural cure of disease. The severe headache, which is relieved by a copious bleeding from the nose, or the bilious attack which culminates either in sickness or diarrhœa, and is thereby speedily cured, illustrate other ways and means of natural cure; just as the healing of the scratch on the finger, by the development of new cells and new tissues, exemplifies this cure in another phase.

Recognizing this principle in nature and life, we are forced onwards to inquire into its origin, cause, and conditions. What is this natural power of healing? How has it arisen in living beings? What are its limits of operation? are all so many questions which crop up in the course of our reflections. Dr. Mitchell Bruce, in the suggestive essay to which we have before alluded, attempts to frame replies to these questions, and, on the whole, succeeds in making out a highly plausible case for our consideration. It is pointed out that of old physicians regarded "the healing power of nature" as a something implanted in the body, as was the principle of a tendency to disease. A power of disease and a power of healing, were thus regarded as existent in the body, and as opposing one another. In olden times, these tendencies were even personified under the names of "demons" or "familiars," the *archæus* or *anima* being the healing and favouring spirit.

Succeeding these primitive notions of things, we find the scientific explanation ousting the "demons" of old from their place in human beliefs. If it be true, as admitted, that we are the creatures of progression, we can frame a theory of the healing power of nature, on the foundations supplied by the natural forces and powers of the frame.

It is clear that life may in one sense be viewed as an adjustment of the living being to its surroundings. This much is true, whatever theory of nature we may hold. We are perpetually "adapting" ourselves, and necessarily our organs and parts, also, to the conditions of our lives. This is the first great principle of vital action. Then succeeds a second principle or tendency. In the "struggle for existence" which thus ensues, some favoured organs or parts come to the front, while others tend to disappear under the law of "disuse." Between these two forces or tendencies, Dr. Mitchell Bruce would have us see the living being is swayed. Nor is this all. The power of adapting our bodies to varying conditions seems to carry with it, and to include, an overplus of power. For example, the

stomach, as Dr. Bruce points out, does not merely digest the special nitrogenous foods acted on by the gastric juice, but is able to assimilate foods of varying quantity and quality so as to meet wide extremes of digestive needs. So also, in the case of the heart and blood-vessels, we see a power of compensation, and of provision for both increase and variety of work. The pulse can rise or fall as circumstances require, and is thus adapted to meet the exigences of any strain or other condition which may be brought to bear upon the centres.

Tracing back the "healing power of nature" as to its origin, then, we may see clearly enough, in theory, that it represents simply the excess or overplus of vital strength and energy, which has been collected and intensified in the best of the race, and in the best of our organs, which have survived. The exercise of life's duties in a healthy fashion has resulted in this view of things, in the accumulation of a certain deposit-receipt at the bank of bodily power. "It is in this way," says Dr. Bruce, "that we find that our organs are all of them larger than is ordinarily necessary; that we all possess more lung-tissue, more heat, more peptic (or stomach) glands than we generally have occasion to require; that our organs are, in other words, endowed with a certain amount of reserve force, and are furnished with the mechanisms of regulation and relief, which we have just examined, as in the circulation and the body-heat."

With this simple idea of the origin of the powers we possess to resist disease, strain, and injury, we find another topic closely interwoven—that of the nature and causes of the diseases themselves. As the old idea of "demons" possessing the body has waned and died away, so the thought of disease as a kind of distinct entity or force possessing the body for a time to its ailment or destruction, has likewise been relegated to the dreams and myths of the past. The causes of disease are to be found, largely, if not completely, in perversions or extremes of the natural forces by which we are surrounded. Extremes of heat and of cold, the growth and propagation within our frames

of lower forms of animal and plant life, altered blood-pressure in organs (such as the lungs), due to the varying influences of weather, &c.—these, and many other examples, illustrate the origin of disease, through modifications of natural conditions. Even the propagated troubles which we may inherit from our ancestors represent the fruits of similar weaknesses, descending from one generation to another by methods and means of propagation of the most natural kind.

The variations in the means at the body's disposal in bringing about "natural cures" are very considerable. Dr. Bruce enumerates the more generally recognized among such means. Thus there is the process of "throwing off" disease, which is probably best explained scientifically, as the result of the body's increased work and of the display of the "reserve force" of the frame, demanded and drawn out by the exigencies of disease. The healthy body, in truth, is a soil which is perpetually rejecting the disease-matter which it inhales into its lungs, ingests with its food, or otherwise receives within its structure.

But there also exists in *rest* a powerful means of natural cure, and one which has always been widely recognized from the earliest days of physic. Here, again, we are strictly within the limits of "natural cure," for the life of every animal is spent in alternations of work and rest. The heart itself does not perform a ceaseless round of duty. It really rests as much as it works. It has short rests in the intervals or pauses between its short spells of work. Breathing, in the same way, is not a continuous work, but a bodily labour which, as we can readily see, shows rests and pauses between the acts of the work.

We find, accordingly, that nature, in her modes of cure, has but to increase and intensify this principle of natural rest, to secure for the affected organ or part the opportunity to regain lost force or power, and to make headway against the tide of disease. When the physician prescribes rest, or endeavours to relieve affected lungs of so much of their work by stimulating skin and kidneys to increased activity, he is only availing him-

self of the principle of natural repose. In a highly ingenious manner has nature provided for the rest of the heart by making the arteries (or vessels carrying pure blood to the body from the heart) highly elastic tubes. The elastic character of these blood-vessels maintains and carries on the impulse of circulation which the heart begins, so to speak, with each stroke. The artery takes up the work which the heart inaugurates. The heart does the first four-tenths of the cycle of circulation, the remaining six-tenths—during which the heart rests—are performed by the arteries. Increase this tendency to rest, or modify it in one way or another, and you at once procure or evolve a powerful means of combating the strain of extra work or the inroads and demands of disease.

So is it also with breathing. The economy of nature is here illustrated, in equally clear fashion to that exhibited by the heart. It is "breathing in," or *inspiration*, which gives us all the trouble, and which costs us a high muscular effort. "Breathing out," or *expiration*, which is merely the recoil of the elasticity of the chest, and the return of the chest to its position of rest, costs us no effort. Power is thus economized, and labour saved in the discharge of life's duties; while the principle of rest comes to the front, when required, as a relief for pain and from the pangs of disease.

Again, nature's cures, as we have already hinted, are often direct, and appear to antagonize the causes of disease by attacking, through the mechanisms of relief which the body contains, the actual source of ailment. Spontaneous bleeding, vomiting, diarrhœa, are examples of such actions. There are also illustrations well known to physicians, of so-called *vicarious means* of relief, where strain in an organ or part is relieved through the action of another organ. Here it would seem as if, helpless to aid itself, the affected part appealed with success to the bodily community at large, and received the aid in need of which it stood.

Limits to natural cure, and failures of nature to accomplish

such cures, are, of course, frequent. It could not be otherwise in the case of the living body struggling to maintain its footing amid the diverse circumstances which make up the world of life. Thus, the heat or cold to be resisted may prove too great for the body's power of resistance. The body's strength may be exhausted in the struggle against disease. The demand or strain may be too sudden in its character. Want of the power to adapt itself or some of its organs to new circumstances may again operate to produce failure of life's work of cure. It is here that we see the distaste for and inability to bear the action of tobacco and other drugs in some individuals, notwithstanding persistent efforts to accustom the body to their use. Nature fails to produce the accommodation ; and the *habit*, which might prove useful as a means of cure under certain circumstances, never becomes established. So, also, while in most cases one attack of a fever protects the body against subsequent attacks, there are cases in which an utter want of this "fever habit" is seen, and in which the individuals are attacked by every epidemic of the disease which appears.

Last of all, as Dr. Bruce points out, there are certain *vicious circles* of action which may defeat nature's cures. Liver disorder produces nervous languor, and this, in its turn, increases the biliousness. Poverty of blood causes indigestion and constipation, which, in their turn, further and viciously affect the vital fluid. Here, again, we are only witnessing the operation of natural law. One organ or part of a tissue has become dependent on others. A circle is formed, and the diseased action beginning at any point in that cycle traverses the whole.

Failures and want of power of accommodation notwithstanding, it can still be shown that these bodies of ours possess a wondrous power of natural cure, the result of an equally wondrous evolution of vital power, operating through the long ages of the past.

THE RESTORATION OF "DEAD" ANIMALS.

Public attention has been drawn to certain experiments said to have been carried out at Denver, Colorado, and having for their object the solution of the question, "Can animals which are practically 'dead' be restored to vital activity?" In the experiments alluded to, a dog, for example, was bled to death. Its body passed through the stage of muscular rigidity—*rigor mortis*, or "death-stiffening," as it may also be called. Its frame became stiff and cold, and for three hours was left in this condition. Thereafter, it was placed in a warm bath, hot water was injected into the stomach, means were adopted for artificial respiration, and, finally, blood from the veins of a Newfoundland dog was injected into the empty blood-vessels of the "dead" animal. The result was that in about twenty minutes thereafter the dog "sat up," and in two days was able to run about the streets.

Such were the main facts in the history of at least one animal said to have been experimented on at Denver. In giving an account of these experiments, I distinctly warned my readers, as a matter alike of scientific caution and ordinary common sense, against accepting the statements made on the bare authority of the published accounts. I noted the lack in the accounts of many details which the man of science was bound to inquire for and to demand before he admitted even the possibility of such experiments being the realities which the newspaper accounts would have us believe them to be. If the experiment of reviving a dog which had not merely been bled to death, but whose body had passed into a condition of death-stiffening—indicating serious chemical alteration of the muscular substance—was to be accepted as a possibility of science, I judged it right, in addition, to remark that we should hear more of the experiments and their verification, and that, moreover, in a scientific dress.

While we are still waiting—and I may add likely to wait for an indefinite period—for news from Denver, and for the proof and verification of these wondrous tales which are necessary for the scientific examination of the question, I find that Dr. B. W. Richardson, in the current number of his excellent journal, *The Asclepiad*, devotes an interesting article to the recapitulation of experiments on resuscitation of animals, in which he himself engaged some years ago. Dr. Richardson had noted my observations on the Denver narrative, and he also refers to the experiments of Dr. Blundell, Harwood, and Sir Christopher Wren. My distinguished friend thinks my scepticism regarding the actual restoration of animals "from what seemed to be actual death from loss of blood" by the injection or "transfusion of blood from another animal of the same species," may be qualified when the experiments of Blundell, Kaye, Hastings, and others are borne in mind, My remarks, however, had special reference to the whole gist of the Denver experiments in particular, and not to experimentation on restoring apparently "dead" animals at large. Moreover, I am glad to note that Dr. Richardson is at one with me in exhibiting a natural caution when we are told that animals have been restored to life after a lapse of several hours passed in what is practically a state of death, as evinced by that most certain of the signs of life's cessation, the *rigor mortis* to which allusion has been made.

So the scepticism regarding the Denver experiments must legitimately be allowed to remain strongly developed, as things are. But Dr. Richardson introduces us to a collateral, and withal more profitable, study—namely, to the record of his own investigations on the resuscitation or restoration of animals, undertaken with a view of benefiting human beings who are occasionally placed in like need of reviving after drowning, chloroform-administration, shock, cold, and other conditions. It is to the results obtained by Dr. Richardson that I now propose to direct attention. A study of high scientific interest, and one

of deep practical utility in its relations to the saving of human life, is thus included in the history of the researches thus republished in the *Asclepiad.*

In the majority of cases a rabbit was the animal experimented upon. In all cases death was painless, and carried out by methods other than those of bleeding, while attempts to restore life were never made until every recognizable sign of life had ceased. In the first instance, Dr. Richardson drove a current of pure oxygen gas, warmed to the natural temperature of the body, into a vein, in the hope that oxygen-laden blood, carried to the left side of the heart, would stimulate not only that organ to recommence its work, but would also influence the whole circulation in the arteries. This experiment, "many times repeated," says Dr. Richardson, "produced no more than a temporary effect upon the heart." The right side of the heart was made to contract often for an hour at a time, but the ventricle (or propelling chamber of that side) could not be made to work powerfully enough to send blood through the lungs, so as to reach the left side of the heart, and thus to pass onwards to the body. Conversely, oxygen introduced into the left side of the heart failed to accomplish the desired result, although, in one case, injection of oxygen at 96° F. into the structure of the heart twelve hours after death, produced feeble contractions.

Peroxide of hydrogen was next employed. This substance (H_2O_2) which differs from water (H_2O) in containing double the amount of oxygen found in the latter fluid, readily gave up oxygen to the blood. The result was seen in vigorous contractions of the muscles of the neck and breast, and of the *midriff* or *diaphragm*—the great muscle used in "breathing-in;" but on no occasion was there any reaction of the heart.

Trying next the effect of injecting venous blood into the veins, and arterial or pure blood into the arteries, no results were produced. Indeed, the effects of what might legitimately have been regarded as a most hopeful means of influencing the work of heart and lungs were highly negative and proportion-

ately disappointing. In the case of heated water a different result was obtained. Hot water was injected into the arteries of the dead animals. Movements sometimes occurred in the muscles, voluntary and involuntary alike. If the body were very cold, and the water heated to 120° F., "muscular movements," says Dr. Richardson, "were sure to be developed." Even when injection of blood failed to produce any effects, the injection of water at 125° F. would be followed by muscular irritability. After a long exposure to cold, such muscular symptoms were produced in the body of an animal by injection of water of 140° F.

The use of a syringe connected with a blood-vessel, and so adapted as to imitate the movements and to supplement the action of the right side of the heart in forcing the blood of the body onwards to the lungs, while apparently correct in theory, failed in Dr. Richardson's hands. Here, the experimenter used the blood of the animal's body. He introduced no new or artificial fluid, but merely aided the action of the heart. Hence, while the principle seems to be correct, the failure arises apparently from the fact that the blood could not be sent through the lungs with force sufficient to enable it to pass as in nature to the left side of the heart and body at large, owing to the arteries being filled with gasses or vapour, which oppose the artificially-induced current. A similar experiment, attempted on the left side of the heart by sending pure blood into that side from the lungs, set that organ working, and also stimulated muscular action in parts to which the blood made its way. The operation is complicated, however, and as it necessitates the opening of a large artery, it would be impracticable in the case of man.

Blood heated to 90° F., and injected by "pulsating strokes" into the arteries of the heart itself, have the effect of causing the animal's heart to exhibit active motion for twenty minutes, and this after it had been "dead" for sixty-five

minutes. The heart's action continued for a minute or two after the pulsating action was stopped, but was renewed several times by renewing the operation. Artificial circulation, by pulsation, through the arteries at large, was intended to imitate a supplementary left side of the heart, existing outside the body. In one case in which this method was tried, with water at 115° F., there was such a general return of muscular symptoms and of reanimation, that Dr. Richardson tells us he "stopped the process in order to prevent a possible return to conscious life." Is it not somewhat of a pity, in the interests of human exigencies, that this experiment was not carried out to complete success? It was demonstrated by this experiment, at least, that it is possible to establish completely an artificial circulation of blood in the animal body, and this fact alone, is no light gain in face of the possible development of these methods of restoring animation after apparently fatal chloroform-administration, drowning, or other accidents of human life.

The power of electricity to restore animals in which the vital functions had been suspended, has long been regarded, from a popular point of view at least, as highly effective. There is scarcely a story of the restoration of half-hanged or half-killed persons, in which electricity does not figure as the paramount mode of inducing the pulses of life to resume their wonted activity. Doubtless, in certain circumstances, electricity is a powerful means of stimulating the action of heart and lungs, where such action is still in existence, but operates at what may be called "low tension" speed and power. Hence, Dr. Richardson was fully justified in expecting that electrical stimulation of the heart might yield valuable results as a successful means of restoring the circulation. In one case, after an animal "had been dead from chloroform for ten minutes," a battery specially constructed to work along with a double-acting bellows was used, so that four discharges from the battery were delivered to the heart to each inflation of the

chest with air from the bellows. The result was that in a short time the heart contracted, and signs of reanimation became so evident that Dr. Richardson ceased the experiments, as in a previous case, to avoid possible restoration of conscious life.

I may now sum up the results of these experiments, and add some observations regarding their general bearings in the great question of the restoration to life after our animal has succumbed to apparent "death." Here, as in so many other cases of problems relating to human weal or woe, the study of lower animal and plant life is found to assist us. We know, for example, that many seeds can remain in a condition of "dormant vitality" for years, if not for centuries, and yet spring into full fruition on the application of moisture and other conditions necessary for germination. Again, among animals, there exists the *Rotifera* or "wheel animalcules," creatures common in the gutter of house-roofs, in stagnant water, and elsewhere, which can be dried so as to appear as mere dust-specks, which can be kept in this mummified state for weeks or months, and which can thereafter be revived into full vital activity by the mere addition of water. When we further discover that such animalcules possess a highly complex frame, including a digestive system, nervous system, sense-organs, muscles, &c., we may naturally feel puzzled to account for the possession of such wondrous powers of resisting conditions which are usually fraught with death to both higher and lower organisms.

Among animals belonging to man's own class, that of the *Mammalia*, we find cases wherein life is maintained for months at low tension power. That the bear, dormouse, bat, and other animals *hibernate*, or sleep through the winter's cold, is a fact of childish zoology. These animals feed well in summer and autumn, then retire to their winter haunts, and pass the cold period in a state of drowsy slumber. In such cases the animals

are undoubtedly alive, but, like living engines, they have "blown off steam," so to speak, and carry on the work of life at low pressure. The heart beats more feebly than is its wont; the breathing is carried on at a slow rate, and the animal-body appears to feed upon itself for the time being, and to utilize in its nourishment the substance, and especially the fat, it has accumulated during its period of summer activity.

In the case of the human being there are not wanting examples which appear to prove that the state known as that of *catalepsy* or trance—so often mistaken for death itself—may occasionally be induced at will. Readers of the text-books will be able to recall to mind the apparently authenticated cases of Indian fakirs allowing themselves to be actually buried for weeks, and thereafter being dug out alive. It is true there may be a suspicion of trickery here, more especially as the Hindoo is given to acquiring a high dexterity in magic and conjuring of a very complex type. But we can at least appeal with confidence to cases of "trance" where the human being, like the hibernating animal, or rather in a far more excessive and typical degree, may pass into a state of seeming death, where the heart cannot be detected in its pulsation, where breathing ceases, where the body becomes cold, and where the danger of premature burial becomes consequently incurred.

Or we may point to the well-known case of Colonel Townshend, who, in the last century, exhibited before his physicians the marvellous power of producing the trance-like state at will. This gentleman, laying himself quietly to sleep, would still the heart's action, breathing, and all other signs of life so thoroughly that even his physicians were deceived, and began to imagine the Colonel had really departed this life. A looking-glass held to his lips retained its clearness, and was utterly undimmed by the faintest moisture. At length the signs of life began to reappear, and in a short time Colonel Townshend awoke to consciousness.

Now, I am very far from maintaining that the foregoing examples lead us nearer to the explanation either of death or of the nature of the state from which men and animals can apparently be recovered, but analogy often helps us in our endeavour to marshal facts in due order, and, at the least corrects the idea that there is anything absolutely unique in the idea of restoration from a state which, to all appearance, and to all scientific observation, is that of "death." The practical question which still faces us, however, may be put thuswise :—Assuming that an animal has died, that is, may be pronounced "dead" in the only sense in which we can truly use that term, have we any reason to expect that science can hold out any hope of reviving the lost life or vitality? To many this question will appear preposterous on the very face of its terms. But let us pause for a moment in our thoughts and ask, "Do we know the nature of life?" I apprehend this query will meet with an unhesitating negative reply; and, if so, I would supplement this question by another, namely, "May not that which we are content to call 'death' be, after all, a many-sided, varying condition, capable, in some cases at least—possibly in many cases—of being overcome by the application of measures which serve to foster the vital powers, which, like those of the human being in the trance, or of the wheel animalculæ, or the seed, have sunk into abeyance."

Of course, that there is a point in the history of an animal when such hopes of recovery are utterly extinguished, goes without saying. The evidence of decay and decomposition is irresistible, and I should say that, in the present state of our knowledge, the occurrence of the *rigor mortis* (i.e., "death-stiffening" of the muscles) is in itself a piece of evidence which, as regards death, may be taken as almost conclusive, seeing that such changes can only occur in the muscles when the ordinary living reactions of their tissue are destroyed or

annihilated. We have no evidence to show that this stiffening can be overcome or abolished so as to enable the muscles to resume their original character and functions. Hence it is tolerably certain that all experimentation carried on with the view of restoring the vital powers must deal with the body at a period before chemical and physical changes have affected the tissues to any great extent.

Dr. Richardson is himself prepared to find that what is now regarded as "practical death," in cases where there has been no disease, poisoning, or marked injury, may be held to be a condition capable of recovery "before the close of the present century." Such cases as chloroform-stupor, "death" from loss of blood, choke-damp in mines, drowning, and shock, will present the most favourable opportunities for the recall of the vital powers. Even to-day the "drowned man," pulseless, pale, cold, and with lungs apparently at rest, is revived after hours of hard work. What can often be effected in his case, it may be urged, will be carried out successfully in many other instances now regarded as relatively hopeless.

"Extreme cold," in Dr. Richardson's opinion, may surmount difficulties in the way of restoration at present found in the shape of clotting of the blood, the death-stiffening of muscles, putrefactive changes, &c. He quotes certain remarkable cases in which life goes on at "low tension"—"smouldering life," as he well terms it, in place of the active burning vitality of ordinary existence. Carps, accidentally frozen in ice, were sent to Dr. Richardson from Newcastle-on-Tyne, after having been "many days" in this state. He carefully thawed them, and restored seven out of eleven to "healthy activity." How long the fish lived thereafter is not recorded. Four toads frozen in a block of ice were reanimated, "although," says Dr. Richardson, "they were so condensed and hard that they were more like stone than animal structures when they were removed from the ice." A frog rendered insensible by nitrate

of amyl (used for the relief of certain heart diseases in man) recovered after nine days' insensibility. In another frog, recovery was seen even "after signs of putrefactive changes were developed."

But in these cases—those of "cold-blooded" animals, be it noted—as Dr. Richardson points out, there was no actual "death," any more than the half-drowned man can be regarded as truly "dead." What we still require is information regarding the nature and extent of the changes which ensue in a living body up to the point when death actually occurs; and, furthermore, we require distinct knowledge regarding the exact "zero" or vanishing-point of life in different animals. That this "zero-point" is placed much lower on the vital scale than is commonly supposed, I feel strongly inclined to believe. Cases now regarded as hopeless of revival, of injury, loss of blood, &c., in a future era of science will, I am persuaded, be brought "back to life."

Conversing over these matters with a friend ardent in scientific research, the observation was made to me that he did not believe Dr. Richardson's carps were really "alive." He maintained they may have been like "snuffed-out candles." "You have still your animal candle," said he; "and you relight by thawing it." Personally, I do not agree with this view of matters. I cannot find any scientific justification for its acceptance. But it would indeed be strange if, among the possibilities of science in the future, the actually "dead" body could be shown to hold for a time the power of being "relit" as it were. Who knows what the future march of research may disclose regarding the nature of life? and as concerns the possibilities of relighting the vital torch, under conditions now deemed hopeless of recovery, who can tell?

MEDICINE IN QUEEN ANNE'S DAYS.

In his interesting book, "Social Life in the Reign of Queen Anne" (Chatto and Windus, London), Mr. Ashton has an instructive chapter on the medical fashions and ways which characterized the period of history just named. Mr. Ashton tells us that in the reign of Queen Anne, quackery was as rampant as it is to-day. The regular practitioners were rather at a discount, because faith in the faculty was an element in the popular character which had not undergone development, and because the scientific practice of medicine, founded on observation and experiment, had not then superseded the rule-of-thumb and empirical modes of treatment which are characteristic of the medical art of every country at a certain stage of its history. In Queen Anne's reign, it would seem, the alchemists still lingered on the stage of time. This is proved by Mr. Ashton's production of an advertisement of the day:—"Whereas the Viper hath been a medicine approv'd by the Physicians of all nations; there is now prepar'd the Volatile Spirit compound of it, a Preparation altogether new, not only exceeding all Volatiles and Cordials whatsoever, but all the Preparations of the Viper itself, being the Receipt of a late Eminent Physician, and prepar'd only by a Relation. It is the most Sovereign Remedy against all Faintings, Sweatings, Lowness of Spirits, Vapours, &c.—As also in all Habits of Body or Disorders proceeding from Intemperance, eating of Fruit, drinking of bad Wine, or any other poysonous or crude Liquors, and is good to take off the ill Effects or Remains of the Bark or Jesuit's Powder." From which announcement it will be seen that the quacks of our own day do not enjoy a monopoly of advertising tact, or of confidence in announcing the merits of their preparations.

The medicines in use in Queen Anne's age were no less curious than the phraseology in which their virtues were couched. "Live hog lice," "Burnt cork quenched in aqua vitæ," "Red coral," "New gathered earth-worms," "Black tips of crabs' claws," "Man's skull," "Elk hoofs," "Goose dung, gather'd in the springtime, dry'd in the sun," "Unicorn's horn" (probably the narwhal's tusk), "Inward skin of a capon's gizzard," "Frogs' livers," and many other curious compounds were largely used. A remedy for small-pox was called the "Black Powder," and was composed of "Live toads, No. 30 or 40; burn them [continue the directions] in a new pot to black cinders or ashes, and make a fine powder. Dose, half a drachm or more in the small-pox, &c., and is a certain help for such as are ready to die; some also commend it as a wonderful thing for the cure of the Dropsie." Another curious compound was called "A Powder against the Yellow Jaundice." This estimable compound was prepared as follows:—"Goose dung, gather'd in the Springtime, dry'd in the Sun, and finely powder'd, two ounces; the best Saffron one drachm, white Sugar Candy two ounces, mix, and make a powder. Dose, two drachms, twice a day in Rhenish Wine, for six days together." Another remedy was composed of "Roots of turmerick, white tartar, Mars prepared;" half an ounce of earth-worms was to be added to the decoction, along with two ounces of "choice rhubarb." The dose was one drachm "in a little glass of wine; but," adds the narrator and adviser, "an acquaintance of mine, a learned physician, usually makes both the compositions into one, and assures me that he has never found it to fail." After such a recital, one feels tempted to add, great must have been the faith of patients in those days!

In 1706—the date, it may be added, of the volume from which the foregoing prescriptions were taken—the ideas which were entertained regarding the cure of epilepsy or "falling

sickness," were so curious as to deserve special mention at our hands. The chief remedy was that known as the *Corvus Epilepticus*, or the "Anti-Epileptic Crow or Raven." The greater crow or raven was to be first plucked—"deplumated" was the pedantic term used in the reign of good Queen Anne—and then to have its internal organs taken out. The heart, lungs, liver, &c., were then to be put into the belly of the bird with galangal and aniseeds. Then came the process of baking. The bird thus treated was to be baked in an earthen vessel "well shut or closed in an oven, with household bread." After cooling, the flesh was to be "separated from the sides or bones," and the operation of baking to be repeated a second or third time, when a "powder" was to be made of the bird's baked anatomy. "It is a famous remedy," says the authority, "for the falling-sickness;" and after such a recital we may well feel lost in contemplation of the marvellous inanity of the whole procedure, which retains about as much common sense or science in its nature as the witches' prescription in "Macbeth," or the love-potions of the Middle Ages.

In the days of Queen Anne, bleeding and purging formed the sheet-anchors of medical and surgical practice. Bleeding, of course, held its own to a much later period, as a legitimate feature of modern medicine; but in the times of which we are speaking, the lancet was at once a most formidable weapon in the hands of physicians, and it may be added, a powerful enemy of health as well. One Thomas Brown, writing in his book called *The Dispensary*, makes a fashionable physician in these days thus describe his practice. "He pays well," says this authority, "and takes Physick freely; besides I particularly know his Constitution; after Bleeding he must take a Purge or two, then some Cordial Powders, Dulcifiers [this expression is a singularly choice one] of the Blood, and 2 or 3 odd things more. . . . I tell you 'tis an easie thing for a Man of Parts to be a Surgeon; do but buy a Lancet, Forceps, Saw;

talk a little of Contusions, Fractures, Compress and Bandage; you'll presently by most People be thought an Excellent Surgeon. . . . I myself have turn'd out several Doctors out of Families because they would not prescribe Physick *plentifully*, and in large Quantities. I have perswaded my Patients that they did not well understand their Distemper; so have brought in another who has *swingingly dos'd 'um.* I could tell you of a Sir *Harry* that paid an 100*l.* for Physick in six Weeks, and I accepted it, being a Friend, without requiring one Penny for my own Fees." Most persons will be of opinion that the physician in such a case would have been more than liberally paid.

The division of the medical profession into physicians, surgeons, and apothecaries, was one fully recognized at the period with which we are dealing. Addison, in the *Spectator*, says of the first two grades, that "An Operator of this Nature might act under me with the same regard as a Surgeon to a Physician; the one might be employed in healing those Blotches and Tumours which break out in the Body, while the other is sweetening the Blood and rectifying the Constitution." The apothecaries of these days, of course, corresponded to the modern druggist. At this period, also, the College of Physicians of London exercised certain "trade rights" over their special district. In his "London Spy," Ward tells us that no one, even though a "Graduate in Physick" of Oxford or Cambridge, could practise in or within seven miles of London, save under licence of the "Colledge Seal." No practice was permitted in any other part of England by persons who had not taken "some degree at one of the Universities." Ward grows highly sarcastic later on over the oath which the College had power to administer, and which was as "practicable to be broke the next day" as it was to be taken. The College could "Fine and Imprison Offenders in the Science of Physick," "and all such who presume to Cure a

Patient when they have given 'em over." Its members could make bye-laws " for the Interest of Themselves, and Injury of the Publick;" and so on. There may have been some truth doubtless in this account of the abuses of College privileges, but of the existence of malice and satire in Ward's account of them no question can be entertained.

In these days, the visiting physician's fee was a guinea, although, strangely, the consulting one's honorarium was less. The dress of a "Worshipful Graduate in the noble Art of Manslaughter" is thus described:—"A suit of black (velvet, if possible), a full-bottomed wig, a muff, a gold- or silver-headed cane, formed the outward adornment of the physician." It might be added that in the top of the cane was a small box, which the gold head concealed and covered; this receptacle being generally filled with aromatic vinegar, which was believed then, as now, to be a corrective and antidote to infection.

In the days of good Queen Anne, the practice of "cupping" seems to have been much in vogue. Bleeding and purging were the mainstays of medical practice in those days, as we have seen; but "cupping" would appear to have been quite as fashionable in its way as was either of the former remedial measures. The operation is thus described by a writer of the day:—"The Operator fetched in his Instruments, and fixed three Glasses at my Back, which, by drawing out the Air, stuck to me as close as a Cantharides Plaister to the Head of a Lunatick (a hint showing how the insane were treated in these "merry old days") and Sucked as hard as so many leeches, till I thought they would have crept into me, and have come out on t'other side. When by Virtue of this *Hocus Pocus* stratagem, he had conjur'd all the ill-blood out of my Body under his glass Juggling Cups, he plucks out an ill-favour'd Instrument, at which I was as much frighted as an absconding Debtor is at the sight of a Bill of Middlesex, takes off his Glasses, which had made my Shoulders as weary as a Porter's Back under

a heavy Burthen, and begins to Scarifie my Skin as a Cook does a Loin of Pork to be Roasted. . . . When he had drawn away as much Blood as he thought Necessary for the removal of my pain, he cover'd the Places he had Carbonaded with a new Skin, provided for the purpose, and healed the Scarifications he had made in an Instant."

The treatment of lunatics has already been incidentally alluded to. In Queen Anne's days, it is needless to say, the humane and scientific treatment of the insane, founded on a knowledge of the true nature of their maladies, and practised to-day, was utterly unknown. The mention of a "Cantharides plaister to the Head of a Lunatick" is an indication how the insane were treated in the pre-scientific age of medicine; but there are not wanting evidences in detail of the nature of the expedients whereby, in these times, lunatics were not cured, indeed, but only restrained. "At the Pestle and Mortar on Snow-hill," says an advertisement of the period, "is a Person who has had great Experience and Success in curing Lunaticks; he has also conveniences for Persons of both Sexes, good and diligent Attendance for the best ranks of people, and having for several years past perform'd it to the satisfaction of many Families. He therefore makes this Publick, to inform, where in very reasonable rates the same Cure shall be industriously Endeavour'd and (with God's blessing) Effected." As Mr. Ashton remarks, a little light is thrown on the treatment of those who were not even insane apparently, by the advertisement of "A Dumb Young Man *broke his Chain* last Wednesday Night, and left his Friends from their House in Compton Street, next door to the Golden Ball Alehouse, Soho, and those that will take Care to bring him Home, shall be Rewarded. He has been Mad (?) these 23 years."

Four celebrated physicians were connected with the reign and times of Queen Anne—Dr. Radcliffe, Sir Samuel Garth, Sir Hans Sloane, and Dr. Mead. Of Dr. Radcliffe many curious stories were told. One Hannes, a rival of Radcliffe's

for the hand of a young and wealthy lady, had started a beautiful carriage. A friend having remarked that Hannes' horses were the finest he had seen, "Ah!" snarled the doctor, "then he'll be able to sell 'em for all the more." He was noted for squabbling over the payment of his bills. A paviour had repaired the pavement in front of his house. When he applied to the doctor for his money, he was told that he had spoiled the pavement and had covered it with earth to hide his bad work. "Doctor," said the man, "mine is not the only bad work the earth hides." Radcliffe refused to attend the Princess Anne, who had become hypochondriac after the death of her sister, Queen Mary. He returned a message from a tavern in St. James's, where he was enjoying his potations, that it was all fancy, and that the princess was perfectly well. But, on presenting himself at the Palace next morning, Dr. Radcliffe was informed that he had been dismissed, and that Dr. Gibbons had already been appointed Court physician. When the Queen lay dying, and he was summoned, he again refused. He had "taken physic, and could not come." The populace rose against the doctor after the Queen's death, and there was even a proposal made that he should be required to attend in his place in Parliament—he represented Buckingham—that he might be censured for not attending her Majesty. Radcliffe died shortly after the Queen, on November 1st, 1714.

Sir Hans Sloane may be esteemed the founder of the British Museum, since, having been appointed physician to the Duke of Albemarle, Governor of the West Indies, he brought to England a large collection illustrating the botany and zoology of the countries he had visited. His collection he sold to the nation for 20,000*l.*, paid to his family. Montague House was purchased as a museum, and from such a small beginning sprang the great institution for which London is famous among the nations of the world.

The education of the medical profession in the days of Queen Anne was by no means a thing of scientific precision or

of orderly acquirement. There was no Anatomy Act providing a supply of the means whereby alone a knowledge of the foundations of medicine and surgery can be acquired. We read of Evelyn presenting to the Royal Society a "Table of Veins, Arteries, and Nerves," which he had caused to be made in Italy. Anatomy was taught privately in these days—as, indeed, it is so taught even now, by medical tutors. An advertisement of the time informs us that, "On Monday, the 13th inst., Mr. *Rolfe*, Surgeon in *Chancery-lane*, intends to begin at his House a compleat Course of Anatomy on Human Bodies, viz., Osteology, Myology, and Enterology; to be continued every Monday, Wednesday, and Friday." The barbers of these days—barber-surgeons, in truth—bled, drew teeth, and performed other minor operations in surgery, without let or hindrance. But it was perhaps reserved for the oculists of these times to indulge in the most fantastic advertisement of themselves and their cures, real or supposed. Sir William Read, oculist to her Majesty, began life as a tailor, and rose to a high position at Court. Mr. Ashton gives an illustration from a handbill of Sir William's, published about 1696. The surgeon himself, in a flowing wig, is operating on the eye, while an assistant, standing by, holds a cloth over the patient's head. These handbills of Read's contain lists of his "wonderful cures." He had set "wry necks" right, remedied hare-lips, cured "cancers," trepanned skulls, operated on wens, cured dropsies, "cut off a man's leg, and given sight to numerous people who were born blind." The idea of a fashionable medical baronet distributing illustrated handbills, and thus vaunting his cures, shows us how far ahead we are in the present year of grace when we compare ourselves with the days of good Queen Anne.

Read's knighthood is thus recorded in the *London Gazette* of July 30th and August 1st, 1705:—"Windsor, July 27. Her Majesty was this day gracious pleased to confer the Honour of Knighthood upon William Read, Esq., Her Majesty's Oculist in Ordinary, as a mark of her Royal Favour, for his Great

Services done in curing Great Numbers of Seamen and Soldiers of Blindness, *gratis.*" Lady Read was duly advertised as also attending to patients—lady medicalism was not unknown in Queen Anne's time. It was of this oculist that Dean Swift wrote to Stella, when he speaks of an invitation to Sir William Read's. "Surely," says the Dean, "you have heard of him. He has been a mountebank, and is the Queen's Oculist; he makes admirable punch, and treats you in gold vessels"—from which it may be inferred the Dean's sympathies were rather with the punch-making than with the surgical powers of the "Queen's Oculist."

Sir William Read, surgeon-oculist "in Ordinary" to Queen Anne, whose ways of advertising (for a court-surgeon, at least) must appear to us of somewhat extraordinary kind, had a rival in one Roger Grant, who was also "sworn oculist" to the Queen. Grant, so report said, began life as a tinker, and was afterwards an Anabaptist preacher in Southwark. Mr. Ashton quotes the following lines of the day in reference to the doings of Read and Grant :—

Her Majesty, sure, was in a Surprise,
Or else was very short-sighted,
When a *Tinker* was sworn to look after Eyes,
And the Mountebank *Read* was *Knighted.*

Grant did not fall behind his rival in his successful advertisement of his cures. He obtained "certificates" from the mayors and aldermen of Durham, Coventry, Hull, and elsewhere, detailing the authenticity of his cures—although the opportunities and training of these respective corporations may, for such a task, of course, be open to question. A tract was issued bearing the title: "A Full and True Account of a *Miraculous* Cure of a Young Man in *Newington*, That was Born Blind, and was in Five Minutes brought to Perfect Sight by Mr. Roger Grant, Oculist. 1709." The title is a highly suggestive piece of quack-advertising, and shows the depths or heights

to which medical aspiration had descended, or attained, nearly two hundred years ago.

The newspaper advertisements of the day reveal an astonishing history of quackery of the same nature. "History repeats itself;" and the modern quack is really one with his ancestor of Queen Anne's days, although his style and language have been modified to suit the fashion of the time. The "Volatile *Spirit* of Bohea Tea," the "Spirit of Scurvy-Grass," the "Balsamick Pills," the "Hysterick Tincture," the "Green Cathartic Elixir," the "Volatile Cordial Pill," and the "Electuary of the Balm of Gilead," are names which appear as if they had been culled from the lists of the alchemists instead of from the repertory of relatively modern druggists and physicians. Of the "Paris Pill and Electuary"—a precious compound of Queen Anne's day—the following account is given:—"The Price of a Box of the Pills is 2s. 6d., and a Pot of the Electuary 1s. 6d., of w^ch Pills and Electuary two Boxes and one Pot will be sufficient for any one not very far gone in the Distemper, and Double the Number will heal the Patient if in Great Extremity. Sold by J. Sherwood, Book Seller, at Popings Aley Gate, Fleet Street. With a Paper of Directions."

Quack rivalry was not unknown in these days. We find that the public were requested to "Beware of Counterfeits" (of "Dr. Anderson's, or the Famous Scots Pills"), and especially of "an Ignorant Pretender, one Muffen, who keeps a China Shop, and is so unneighbourly as to pretend to sell the Same Pills within 3 Doors of me."

A quack harangue, quoted by Mr. Ashton, is so humorous in its way, that no apology is needed for quoting it at some length:—"Gentlemen, you that have a Mind to be Mindful of Preserving a Sound Mind in a Sound Body, that is, as the Learned Physician, Doctor *Honorificicabilitudinitalibusque* has it, *Manus Sanaque in Cobile Sanaquorum*, may here, at the small expense of twopence, furnish himself with a parcel which,

tho' it is but small, yet containeth mighty things of great Use and Wonderful Operation on the Bodies of Mankind, against all Distempers, whether *Homogeneal* or *Complicated*, whether deriv'd from your *Parents*, got by *Infection*, or proceeding from an Ill Habit of your own Body. . . . In the next place, Gentlemen, I present you with an excellent outward Application, called a Plaister; good against Green Wounds, old Fistulas and Ulcers, Pains and Aches, Contusions, Tumours, or King's Evil, Spasms, Fractures, or Dislocations, or any Hurts whatsoever, received either by Sword, Cane, or Gunshot, Knife, Saw, or Hatchet, Hammer, Nail, or Tenter-hook, Fire, Blast, or Gunpowder, &c. And will continue its Vertue beyond Credit; and as useful Seven Years hence as at this present Moment, that you may lend it to your neighbours in the time of Distress and Affliction; and when it has perform'd Forty Cures, 'twill be Ne'er the Worse, but still retain its Integrity. *Probatum est*, &c."

An interesting feature of the medicine of Queen Anne's days was the habit practised by the Queen, of "touching" persons for the cure of scrofula, which, in the olden days, received the name of "King's Evil." Edward the Confessor was the first to exercise the supposed gift of healing, while Queen Anne was the last sovereign who thus practised the art. One account of the presumed cure, not by royal touch even, but by deputy, is given in the story of one "Mary Bartey of Deptford," who was "miraculously cured by a handkerchief dipped in the blood of King Charles the First," after "she had been twelve years blind by the King's Evil." This story foreshadows the "faith-healings" of these latter days, and is not a whit more ridiculous in its nature than the recitals of the modern "Bethshans," and their theoretical cures of distorted spines, bandy legs, cancers, and other grave disorders.

The ceremony of "touching" was described by Misson, in the case of James II. The king sat in a chair of state, raised

two or three steps. A reverend Father stood by the king's right hand. After prayers, the diseased—" or," adds Misson, "those that pretended to be so"—were made to pass between two rails, facing the king; each patient falling on his knees at the king's feet. The sovereign then touched their cheeks with his hands; the priest put a ribbon with a gold medal attached round the patient's neck, saying, "The king touches thee; God cure thee." "This," adds Misson, "was done in a trice; and for fear the same patient should crowd into the file again to get another medal—called an 'Angel,' by the way—he was taken by the arm and carried into a safe place." When the king grew tired of his healing functions, the priest simply presented him with the end of the string which was round the patient's neck. The healing power passed from the royal person, through the string, to the patient. After the royal touch, however, we are told, those that were "really ill were put into the hands of physicians, and those that came only for the medal had no need of other remedies." There seems to have been a good deal that was farcical about the ceremony of the "royal touch," after all. The gift of the "medal" had probably more to do with the existence of the supposed disease than the king or his counsellors may have believed.

Queen Anne practised the "royal touch" on Dr. Johnson himself, but, adds Mr. Ashton, "it had no effect." Whether or not the lexicographer's constitution was amenable to royal influence is not known, but probably the good sense of the famous doctor proved more than sufficient to show him the absurdity of the whole procedure. All persons who desired the Queen's "touch" were ultimately required to "bring a certificate to her Majesty's Sergeant-Surgeon, signed by the minister and churchwarders of the parish where such person shall then reside, that they never had before received the royal 'touch' as been heretofore accustomed." It would appear from this latter announcement that grave doubts had been cast on the efficacy of the royal remedy.

A review of Queen Anne's days, in the matter of medicine, teaches us how rapidly we have advanced in the healing art, and in science at large, since the period in question. It is only after such retrospective glances that we can realize the full extent of the culture which is spread broadcast to-day. It is true, quackery of rampant nature still remains amongst us, but we possess the consolation at least of knowing that, if we care to seek it, we can acquire to-day a true knowledge of health-science, easily, readily, and cheaply. The schoolboy of to-day, in fact, may know the elements of health-science in a fashion utterly unrepresented in the highest medical circles in the days of Queen Anne.

CURIOUS FACTS ABOUT MEMORY.

By the term "Memory" we mean the "reproduction of past states of consciousness," to quote Dr. Carpenter's definition—that calling forth in review before the consciousness of what *is*, the consciousness of what *was*. In sober truth, there is no subject within all the wide range of mental physiology more interesting than that which deals with the nature of this wondrous mode of recalling to the "mind's eye" the forms, features, and incidents of persons and events which occurred in the "long ago" of a life. No one may pretend that we have a full explanation of "memory" within our grasp, and still less have we any exact information concerning the manner in which events are registered, localized, associated, and thereafter reproduced by the mental or physical forces. We can only at present study the phenomena which our mental life exhibits to view in respect of memory and its powers. We can at least pay attention to the apparent succession of events which characterize "memory" at large; and we may, in addition, note certain

interesting facts which concern "memory" in its relation to those unusual states of brain, induced by injuries, or resulting from the inroads of more mysterious disease.

Memory, like every other faculty of mind or brain, must be studied from this double point of view—namely, from the normal aspect of healthy brain-action, and from the side of disease. The latter method of investigating nervous actions, or indeed the functions of any part of the living organism, is as necessary as the former. It is only when the facts elicited by a study of natural functions are found to be correlated with those derived from the knowledge of diseased action, that the physiologist can safely verify his theories and substantiate his views and opinions. But for the knowledge of what a study of brain-disease has disclosed, in its telling effects upon the life of the afflicted, many of the conclusions of modern life-science would have been left unsupported and unconfirmed. The by-ways of life often lead us directly to the discovery of truth, as do the pathways of direct experiment. In the case of "memory," this observation holds extremely true. Some of the most curious facts concerning memory at large, are derived from the domain of the physician, and from a study of abnormal brain-action. Life, in short, is a two-sided matter—it presents us with its healthy and diseased aspects; and it is only when a full comparison of the observations derived from both sources becomes possible that any details, approaching in their nature to a complete understanding of living functions, can be mastered and verified.

It may be convenient, as well as explanatory of much that is curious in the phenomena of "memory," if, in the first instance, we glance at certain results to the memory-faculty which follow injuries to the brain. Mr. Savory, F.R.S., in the *Lancet* for November, 1882, relates certain facts which must possess for all students of memory a high degree of interest.

"The curious fact," says Mr. Savory, "that in concussion of

the brain not only may there be complete loss of consciousness for a considerable period after the injury, but that in some cases after complete recovery there may be total loss of memory of all events which have happened shortly before the injury, has not, perhaps, received the attention it deserves. The following cases may be taken as examples :—

"The driver of a hansom cab was knocked off his box by an omnibus at the top of Newgate Street, and brought to the hospital in a state of complete unconsciousness from concussion. From this he speedily recovered ; but, at least for several weeks after, when he appeared to be in every respect quite well, he could not in the slightest degree recollect what he had done or seen, or where he had been *in the half-hour immediately before the accident.* It was known that within that time he had taken up a passenger at Cornhill, and driven along Cheapside and Newgate Street, yet of this he never had the faintest recollection; but for all events up to this time his memory was excellent.

"Again, a gentleman was thrown from his pony at polo, and picked up quite unconscious, in a state of concussion. He recovered from this in the course of two or three hours, and in a few days was as well as ever. But he could never recollect some striking events in the game which occurred *within half an hour or so of the accident ;* yet up to this blank period his memory was minute and accurate.

"Now, what happens in such a case ? I suppose no one can tell. The substance of a brain is shaken, and presumably for a time damaged in some way or disturbed ; or, as we may say, its nutrition is temporarily impaired, and thus may subsequent loss or function be accounted for. The recollection of a bygone event shows that some impression which the brain receives at the time has been registered; and this must be, I suppose, by some change, however subtle, which is more or less durable. Does the violence of the concussion somehow interfere with the

registration of such change; wiping out, as it were, the record before the ink is dry? But such guessing as this only shows how very far I am from understanding the fact."

A similar series of cases has been recently placed on record in the *Edinburgh Medical Journal*, and republished in the "Transactions of the Medico-Chirurgical Society of Edinburgh" (vol. ii., New Series; Session 1882-83), by Mr. Joseph Bell, F.R.C.S., of Edinburgh. The author remarks, firstly, that disturbance of the mental faculties is a common symptom of almost all head-injuries, from the slightest to the most severe. Such symptoms as unconsciousness, loss of recognition of one's individuality, giddiness, &c., are familiar enough as resulting after injury to the head and brain. But what has been less distinctly noted, according to Mr. Bell, is the fact (also referred to by Mr. Savory) that in a certain number of such cases of injury it is found that the patient "has, much to his own surprise, *forgotten entirely*, not the accident itself and the succeeding circumstances only, *but a certain length of time, varying in different cases from minutes up to hours, and even days, with all its actions, pains, and pleasures before the accident happened.*" Mr. Bell's cases present us with some interesting examples of the fact in question. A learned and very able man, nearly fifty years of age, was rendered unconscious (for probably not more than five minutes) by the upsetting of a coach, sustaining two scalp wounds in the accident. Three days after the accident he voluntarily confessed "that he had lost memory, not of what happened after the accident, but of the few minutes which had passed before it." A lad aged nineteen was rendered unconscious for about twenty minutes by a severe concussion, sustained in a railway accident. On recovering, he remembered nothing whatever of the accident, or of occurrences before it, such as his walking to the station, and getting into the carriage. Mr. Bell remarks that this loss of memory is frequently seen after railway accidents, and the unfortunate subjects may on this

account become very confused in a witness-box, and may even be credited with shamming and imposture.

A young miner sustained a fracture of the skull, and passed through many days of unconsciousness. The accident happened on a Monday, he having then gone to his work sober and collected; yet he had completely forgotten everything which had occurred on the previous Sunday, and the greater part of Saturday afternoon and evening. A foreman in a brewery sustained a severe concussion by falling down a deep well. On recovery, he remembered nothing concerning the events which immediately preceded the injury. He could only make guesses at the nature of his occupation, and could not explain what he was doing to the well or to its rope. Previously to his complete recovery this man showed a distinct loss of ordinary memory for facts and events long preceding his injury. On recovering consciousness, Mr. Bell found him odd in his behaviour for some days. He maintained that his surgeon and nurse were "duffers" because they had kept him on low diet. During the first period of recovery he could not recognize his wife, did not know he had such a relation, and so on. Later on he recovered all his faculties, laughed at his former delusions, but could not recall "the lost hour or two immediately preceding the accident."

From the *Lancet* of April 19th, 1884, we extract the following cases, in further illustration of this curious affection of the memory:—"On Dec. 28, 1882, an intelligent boy, aged twelve, was admitted to the Bradford Infirmary, under Mr. Spence, suffering from concussion of the brain. He was one of the unfortunate persons picked out from amongst the *débris* at the Newland Mills chimney disaster. The accident occurred about 8.15 a.m., and the lad was brought to the infirmary some two hours later in a state of complete unconsciousness. There was no external injury, with the exception of an unimportant laceration of the right leg. For five days he lay rolled up like a ball,

unconscious of everything. On the fifth day he spoke for the first time, and after this gradually came to himself. He was discharged completely cured shortly afterwards. This patient remembers nothing of the accident, not even going to work the same morning. The last thing remembered was going to a circus on the previous afternoon in company with another boy. They set out from home with the intention of going to an entertainment at the Mechanics' Institute; but it was so crowded that they were unable to obtain admission, and went to the former place instead. He remembered nothing of the performance at the circus, and nothing afterwards; from entering the place of amusement to the time of regaining consciousness his memory was a complete blank.

"The second case is that of a fairly intelligent boy, aged fourteen, admitted under Dr. Rabagliati. He had fallen from a viaduct in course of construction in the neighbourhood, and was brought to the infirmary some hours afterwards in an unconscious condition. For three weeks he lay like a log, but about this time he showed signs of coming to. At first he was very foolish—would get out of bed and lie upon the floor until removed by the nurse, throw his plate away, &c. . . . Like the other case, there is a blank in the boy's memory. The last thing he remembers before the accident is saying his prayers the night before. He cannot recollect what he did or saw between this act and the accident next morning. His memory up to this blank period was excellent."

Mr. Spence adds:—"The following case has been related to me by Dr. Rabagliati. A young lady, very intelligent, a teacher in an institution, went out for a drive with a lady friend. They drove into the country for several miles, and stopped at a roadside inn to give the horse a drink. To enable the horse to get at the water better, the blinkers were removed. Just at this moment something frightened the animal, and it bolted with the carriage containing the young lady (the friend had

previously alighted). It had not gone far when the carriage. came into collision with a wall, and the young lady was thrown violently to the ground. She was picked up in an unconscious condition, and removed to her home, where she was attended by Dr. Rabagliati. There was a scalp wound, and some severe contusions, but no fracture could be detected. She remained unconscious for some hours, and in a semi-unconscious condition for ten days afterwards, but in the end made a complete recovery. In this case also, there was a total loss of memory for two or three hours before the accident. The patient remembers putting on her bonnet before starting, but going down stairs, entering the carriage, and the journey are all forgotten Her memory for events up to this time was accurate."

In our last paper we noted the curious fact that in cases of head-injury involving loss of consciousness, the patient, on recovery, recollects the details of his past life—that is, exercises his ordinary memory—save those which concern the half-hour, hour, or few hours before the accident. This period—varying in length in different cases—immediately preceding the accident remains a blank in the memory. There is perfect recollection of every event up to within a certain period before the accident. Of the events of this period, the patient on recovery can remember nothing whatever. As I have shown, a man falls down a deep well, sustains severe concussion of the brain, and on recovery is puzzled and amazed at the loss of memory for events occurring just before his accident. "He actually makes guesses at his proceedings," to quote Mr. Joseph Bell's words, referring to this case, "but fails to explain to his own satisfaction, or to that of anybody else, what it was he was doing to the well and its rope." A lawyer, after concluding an intricate piece of business, goes for a ride on the sands. He is thrown from his horse and sustains brain-concussion. After his recovery, he can recollect nothing whatever of the business in question, although his memory for events long

prior to the accident is as good as ever. The "lost hour" in all such cases is that just before the accident. This it is, which is the unwritten part of the mental slate—or shall we rather say the part of the mental slate the writing on which has been blurred, obscured, or perchance rubbed out altogether?

It becomes evident that in the details of such curious results of brain-injury and of loss of memory, we should find some clue to the nature of the memory processes. The expression concerning a thought being "driven out of one's head" would appear to possess an actual parallel in the history of the physical accompaniments or basis of memory. On the whole, the inferences which may be drawn from such cases are clear enough. As Mr. Bell has pointed out, in the act of what is popularly and collectively named "memory" there are at least two distinct processes involved. There must, in the preparation or preliminaries of memory, be a *reception* or *recording* by the "brain-cells" composing the grey matter of the brain of the impression made by the organs of sense. The "gateways of knowledge," as Professor George Wilson long ago named the "senses," receive and transmit to the brain—and if recent research is trusted, to special parts of the central organ of the nervous system—the impressions we ordinarily speak of as the results of seeing, hearing, &c. Then, secondly, the exercise of memory proper involves the power of recalling, of *re*-collecting these impressions—a process varying greatly in different persons in respect of the ease, rapidity, and exactitude with which it is effected. So much, at least, is perfectly clear and evident as regards the essential nature of memory-acts; and this statement may be accepted without hesitation, even though we may be very far from understanding the exact *rationale* of the processes in question.

Turning to the cases described in our last paper, we may be able to note how, from the side of the unusual and abnormal

in brain-functions, we may learn something of the manner in which the normal and natural work of the nervous centres is carried on. It would thus seem to be a matter of tolerable certainty, that each impression made upon the brain-centres as the seat of intellect, requires for its due reception, and for its preservation, a certain period of time. The cases of brain concussion we have studied prove this much. As the sensitive plate of the photographer requires a certain period of exposure for the reception of the image, and as a still further period is necessary for fixation of the image thereon, so it may be said the nervous mechanism demands a certain period for the fixation of the impressions which are to do duty in the "memories" of the future. As Mr. Savory puts it, the mental ink must have time to dry. Any blurring, resulting from concussion, will render the after-production of the impression which we may name "memory," more or less imperfect, feeble, or it may be, altogether impossible.

In opposition to the loss of memory, for immediately preceding events, which a severe shock to the brain is known to entail, Mr. Bell records, what is a common enough experience of all who have had much to do with the administration of chloroform or other narcotics, namely, that "almost always, intelligent patients can recall with great accuracy the last words spoken before unconsciousness." In other words, the insensibility of the brain produced by chloroform does not erase the memory-faculty for events just preceding the administration, as brain-injury obscures the recollection of the patient. There is no "lost hour" in the case of the chloroforming, as in that of brain concussion. It may even happen that if the patient is told to hold up one hand and to count aloud slowly while inhaling the chloroform, the hand falls as the patient ceases to count. After the operation has been concluded it often happens that *the next number to the one last counted is slowly pronounced.* What happens here is, therefore, clear and patent enough.

The chloroform has merely suspended intellectual operations—it has not destroyed them. It has made the period of insensibility alone a mental blank; it has left entirely untouched the registration of the memory-impressions which were present just before the artificial sleep, as it has not interfered with those which succeeded it. So, also, in slight attacks of *epilepsy*, the momentary loss of consciousness which occurs leaves the memory impaired; the patient naturally and exactly resuming his conversation as if no "fit" had intervened.

The interesting deduction, then, remains—that apparently, judging by the results of surgical experience, impressions require a certain period of time for their registration and fixation in the brain. Of the exact time thus required for mental fixation of ideas or impressions we know nothing; but it is a perfectly justifiable inference that the period must vary with the individual constitution. It is more than probable that the "good memory" amongst other qualities, possesses that of ready, early, and rapid fixation of impressions. The monotonous repetition of words and ideas used by many in committing facts to memory, in this light may be viewed as a clumsy method of assisting the powers of mental fixation in question. The individual who requires "time to think" before he can guarantee his remembrance of what he has seen or heard, probably devotes the period of thought to the unconscious and involuntary registration of the impressions he has received; and differences in the rapidity with which ideas can be reproduced in the natural work of the brain, may therefore depend on the ease with which different individuals mentally effect this process of fixation.

That the mere process of receiving impressions and ideas which are afterwards reproduced by acts of memory may practically be of instantaneous character, seems proved by many well-known instances familiar to physiological inquirers.

The following example appears to show that the memory-faculty may be exercised unconsciously, and that the impression

reproduced must have been received with marvellous rapidity and exactitude :—“ In a Roman Catholic town in Germany a young woman who could neither read nor write was seized with a fever, and was said by the priests to be possessed of a devil, because she was heard talking Latin, Greek, and Hebrew. Whole sheets of her ravings were written out, and found to consist of sentences intelligible in themselves, but having slight connection with each other. Of her Hebrew sayings only a few could be traced to the Bible, and most seemed to be in the Rabbinical dialect. All trick was out of the question; the woman was a simple creature; there was no doubt as to the fever. It was long before any explanation, save that of demoniacal possession, could be obtained. At last the mystery was unveiled by a physician, who determined to trace back the girl's history, and who, after much trouble, discovered that at the age of nine she had been charitably taken by an old Protestant pastor, a great Hebrew scholar, in whose house she lived till his death. On further inquiry it appeared to have been the old man's custom for years to walk up and down a passage of his house, into which the kitchen opened, and to read to himself with a loud voice out of his books. The books were ransacked, and among them were found several of the Greek and Latin fathers, together with a collection of Rabbinical writings. In these works so many of the passages taken down at the young woman's bedside were identified, that there could be no reasonable doubt as to their source.”

In this case, the fever served as a brain-stimulant and caused the reproduction of memories, of which, in her healthy and normal existence, the patient could have entertained no recollection; and that impressions, thus marvellously reproduced, must also have been received rapidly and registered indelibly, are also inferences of justifiable kind. Michéa relates an analogous case showing how instantaneously the memory-faculty may operate in certain individuals. A young butcher, living at Bicêtre, suffered an attack of madness. During his

paroxysms, he recited entire passages from the tragedy of "Phèdre." It was ascertained he had only once beheld the tragedy represented; and, on his recovery, he failed to recollect a single verse.

A case of allied nature is that of a man who whilst a patient in St. Thomas's Hospital, London, suffering from a head-injury, spoke in a language, during his partial recovery from his illness, which no one could understand. The language was, however, found to be Welsh. The man was a Welshman, he had been thirty years absent from his native country, and before the accident, had completely forgotten his native tongue. The interesting sequel to these details is, however, found in the fact that when he had completely recovered, "he *completely forgot his Welsh again*, and recovered the English language." It would appear that the accident in this case had exhibited the remarkable fact of stimulating memories which from disuse had practically become obsolete in the normal and healthy existence of their possessor. Of the same order of cases is that of a boy who at four years of age underwent the operation of trepanning for fracture of his skull. After his recovery he had no recollection either of the accident or operation, yet, when suffering from fever at the age of fifteen, he gave, in his delirium, a full account of the operation, of the persons present thereat, and of their dress and other particulars. He had never been known, prior to his illness, to allude to the event of his childhood.

SOME TRICKS OF MEMORY.

Like every other faculty of mind and brain, memory is subject to modification. The elasticity of life is nowhere seen better exemplified than in the variations to which our mental powers

are subject. The very cultivation of memory, and the power we possess, within the limits of our individual constitutions, of improving its scope and enlarging its sphere of action, is a proof of the elasticity and adaptability to which we refer. Naturally, every alteration of memory, or of any other function, does not necessarily tend towards improvement and progress. Backsliding and retrogresion are as much facts of existence as are advance and progression. Organs and functions degenerate through the action of disuse or other conditions, and the laws of degeneration are, in truth, as powerful in effecting change in living beings as are the laws which govern progress. In the matter of memory, the law of disuse holds good to an extent which is popularly well-known as of very wide and extensive kind. The want of exercise of the recollective powers is probably the most common cause of the "bad memories" of which we have so much complaint. A very common case of memory proving a troublesome mental feature, is that seen in the case of a person who in business and occupation has required from day to day for years to exercise his memory over a certain specified and limited set of details. In handling these details, his memory is clear, active, and energetic. But, set down to a different class of facts, and required to exercise his recollective powers over new and unaccustomed ideas, he fails miserably, and at once rushes illogically to the conclusion that he possesses a memory of weak and ineffective kind.

The truth lies in quite a different direction. He illustrates, in himself, a modified memory. His mental powers have become specially adapted, during the years of business, to the requirements of his surroundings. He has no more need to feel surprised that his memory fails him for a new series of facts than in finding that, if bred, say, to watch-making, he should discover the details of tailoring beyond his powers. The majority of us cultivate special memories after all. It is rare, as a matter of common experience, to meet with a person who possesses a memory serviceable for every detail of life.

One man recollects faces, but cannot recall names; another remembers names, but has no memory for faces. In schools, we see one boy or girl with a prodigious memory for routine work, such as historical dates; while another pupil, a dullard as regards dates, possesses a capital memory for long, connected recitations. One person is a perfect walking index to books, and to the source of facts, &c., he has read or heard of; another, helpless as regards this latter power, can cheerfully and easily give a connected account of many details forming a consecutive series. The memory-constitution varies with the individual constitution; and it would be more than strange if this were not so. That which memory-culture should tend to induce, is the production of those modifications in individual memories which will bring to the front the special qualities in which the recollective powers are deficient. It is arrant nonsense to assert that individuals may exist in a state of healthy vigour and freedom from brain disease, and who yet possess no memory powers whatever. Every sane individual possesses a memory, with special proclivities and qualities. Each of us can, by nature, remember certain facts or details better than others. What is wanted, we repeat, in the mental history, is the culture of those powers of memory for which we know we have least aptitude, and which we have least inclination to exert.

Among the "tricks" which memory may play us, none are more interesting than those which relate to the dim consciousness, often present to most persons, of having beheld somewhere or other, at some previous period of life, a scene which is otherwise known or believed to be entirely new. Professor Henry F. Osborn, in *Science*, writes as follows of this well-known mental process:—"For some time past, I have been investigating a curious psychical or psycho-pathological experience which is alluded to by many writers upon psychology, and is not infrequently met with in general literature. It is that vague sentiment of familiarity we sometimes have upon

entering a new experience, best expressed in the words, 'I have seen or known all this before.' It has been explained by various writers, upon two widely different theories. The first is that this 'double perception,' 'double thinking,' 'double presentation,' as it has been variously named, arises from the dual structure of the brain,[1] resulting in cases of imperfectly correlated action in two images or impressions not absolutely simultaneous: the latter, therefore, is a repetition of the former, and gives rise to a sentiment that it has passed through the mind at some indefinite previous time. This theory, it will be observed, is a physiological one. The other theory is, that the phenomenon is a purely psychical one; that the false or illusory memory has a real basis in some actual past presentation which is identical, or closely similar, with the present one, or in some past images of the waking imagination, or dream-life; that, although these cannot be recalled into consciousness, they are sufficient to give us the conviction that the present event is the repetition of a former one—why, or how, we do not know. There are several cases upon record, where this sentiment has assumed a pathological character, and become a continual delusion, attending every experience.

"Two years ago, in the hope of obtaining more information, I distributed a question upon the subject among a large number of persons, principally college students. It may now be given in somewhat amplified form, as follows:—'Have you come suddenly upon an entirely new scene, and, while certain of its novelty, felt inwardly that you have seen it before—with a conviction that you were revisiting a dimly familiar locality? Mention, if you can, an instance or two in which this has occurred. Has any satisfactory explanation of this experience

[1] Mr. Osborn is doubtless here referring to the fact that the brain is a two-sided organ, divided into two distinct, yet connected halves, each of which exercises control over the opposite half of the body.

ever suggested itself to you? How frequent is the experience in your case? Was it more frequent in childhood than at present? How soon do you usually become conscious of the deception? Does it occur more frequently in connection with some kinds of experience than with others?' "

These questions and their full and intelligent considerations naturally suggest the means for arriving (if exact deductions from facts be possible) at an interesting speculation regarding many phases of brain action. That Plato was familiar with the experience to which Mr. Osborn alludes is evident. He even conceived that such ideas gave support to the theory of a state of pre-existence, in which the individual was of course supposed to have seen or heard the details which strike him as being familiar. It has been suggested that just as we received from our ancestors their physical features of body, face, &c., so we must inherit their memory-experiences as well. The "consciousness" of the past, in this latter view, is transmitted onwards to the present, and reappears perpetuated in the dim, ill-defined feelings above alluded to. On this theory, it is suggested that what a person may have seen or heard, and what has impressed him strongly, may be transmitted to his descendants as an inherited memory. Mr. Sully, indeed, in speaking of such "illusions" of memory as they have been named, suggests that a practical test of this ancestral and inherited theory would be that of discovering whether, in the children of seafaring men, brought up inland, there appeared to be any recollection of having seen the ocean before when they were first brought face to face with the sea. Another writer suggests that the dim ideas or illusions in question are the reflections of dreams, but a critic remarks that dreams, too, may be a matter of inheritance. Lewes and Ribot tell us that such illusions are due to the false placing or location of a *present* mental image or idea. Properly placed in the brain centres, it would give the consciousness of a present idea or image not

before seen or heard. Erroneously located, the idea gives rise to a false recollection, and thus originates the dim illusion of a previous knowledge of the scene or words.

Perhaps a distinct theory of these "memory illusions" is at present impossible of construction. But the enumeration of well-verified cases of such "illusions" is a necessary step to their full investigation. In his "Intellectual Powers," for example, Dr. Abercrombie tells us of the case of a lady, who, in the last stage of chronic disease, was taken from London to the country. Her infant daughter was taken to her there, and, after a short interview, was carried back to town. The lady died in a few days thereafter; the daughter growing up to mature age without possessing any recollection of her mother. On being taken into the room in which her mother died, and without being informed of the fact, she started, and was visibly affected; and, in answer to a friend's inquiries, said, "I have a distinct impression of having been in this room before, and that a lady, who lay in that corner, and seemed very ill, leant over me and wept."

Here there was clearly the reproduction—by the stimulation of the surroundings of the room—of ideas which, very early in the individual history, had become impressed in the nerve-centres. But for the known facts of the case, this incident would have been described as a memory "illusion."

A person visits a place for the first time. "When," he asks himself, "have I seen this before?" and although, as far as all his knowledge is concerned, he has never been face to face with the objects or events, a strong sense of recollection is present in his mind.

Professor Osborne relates, in the *North American Review* for May, an interesting incident of this kind, connected with Hawthorne's life.

"During his consulship in England, Hawthorne was travelling near Oxford, and while visiting Stanton Harcourt, had a

curious psychological experience, which he describes in 'Our Old Home.' Nothing about this locality interested him more than the kitchen of the ancient castle. Behind a hearth 30 ft. square, there were two huge fireplaces, used in olden times for roasting oxen whole, while the smoke found its way through great holes in the roof 70 ft. above. This room is one vast chimney, the rough interior walls blackened with the smoke and soot of centuries, and lighted only from the apertures above. 'Now, the place,' writes Hawthorne, 'being without a parallel in England, and therefore necessarily beyond the experience of an American, it is somewhat remarkable that while we stood gazing at the kitchen I was haunted and perplexed by an idea that somewhere or other I had seen just this strange spectacle before. The height, the blackness, the dismal void before my eyes, seemed as familiar as the decorous neatness of my grandmother's kitchen.'"

Here a "memory illusion" was apparently present to the mind. The explanation, however, was soon forthcoming, and it is of highly instructive character, as bearing on the fact that the consciousness of past events and the recollections of things heard, are by no means always represented to the mind later on, in their true light. It appears that in a letter of Pope's, addressed to the Duke of Buckingham, there is contained an account of Stanton Harcourt, where, says Hawthorne, "he resided while translating part of the 'Iliad.' It is one of the most admirable pieces of description in the language. . . . And among other rooms, he dashes off the grim aspect of the kitchen. This letter, and others relative to his abode here, were very familiar to my earlier reading, and remaining still fresh at the bottom of my memory, caused the weird and ghostly sensation that came over me." Here, then, a train of ideas was suggested by a fact long since forgotten. The sense of familiarity constituted an "illusion" only so long as the primary facts remained unremembered.

There seems no doubt that in different individuals these "illusions" of memory are much more frequent than in others. It is probable that they vary greatly as regards subjects also. One person has suggested to him past familiarity with persons, another with sounds, a third with places, and so on. There is equal proof that the "illusions" to which we allude, also differ greatly as regards the period at which they are aroused. The sense of familiarity with an apparently unknown place may arise shortly after the suggestion or reality which gives rise to it has been experienced; at other times the "illusion" is awakened, as in Hawthorne's case, after a prolonged interval.

Discussing now the causes of these "illusions," we have seen that various writers have attributed widely-different meanings to their occurrence. The ancients (Plato, for example) imagined that they were reproductions of events which had occurred in another and previous state of existence. Another and modern view holds that the brain-hemispheres (or halves), which ordinarily work together, are liable to get thrown out of gear, and thus, acting irregularly, give a double meaning, as it were, to what is really a single memory and event. Possibly the true explanation is to be found in the less theoretical arena of common sense as applied to the memory and its ways of working. If we can imagine memory to consist of a connected chain of events or ideas, and that certain of the ideas are less distinctly present than others—that certain links in the chain are lost, or cannot for the moment be supplied—we may arrive at a rational enough explanation of the "illusions" which have given rise to so much speculation and comment.

Cases which support this belief are numerous. If we remember distinctly the steps or links of association (say, 1, 2, 3, and 4) which constitute a full memory, idea, or recollection, there is exact consciousness, or complete knowledge, of the detail in question. But if only 2 and 3 are remembered, 1 and 4 being lost, or for the time mislaid in the mental operations, an

"illusion" is apt to result. The connecting links with past and present experiences being severed, we feel dimly conscious of familiarity with the objects or facts, but are unable to localize them fully and completely. A case illustrating this argument was given in our last paper. An allied instance is related by Dr. Carpenter in his "Mental Physiology." A gentleman visiting Pevensey Castle was oppressed with a sense of familiarity, although he regarded the scene as new. The gateway appeared familiar, and he seemed "to see, not only the gateway itself, but donkeys beneath the arch and people on top of it." On inquiry, he found that he had been taken to the place in the pannier of a donkey when he was only eighteen months old, and that while the elders of the party had held a picnic on the roof of the arch, he had been left below with the attendants and their animals. Another case covers the same ground. A gentlemen, travelling in Missouri, had the impression that one of the battle-grounds of the Civil war was familiar to him. He had no recollection of having visited the spot before; yet he was informed by his parents that he had been carried when young to the spot in question.

Even dreams may complicate the question of memory-illusions, until their true purport and bearing are clearly borne in mind. Persons have dreamt of a certain series of events; the dream has been remembered, and has then been forgotten. Later on, the dreamer finds himself in his waking hours in a place or situation which seems familiar, although he is certain the scene is really new. Then comes remembrance of the dream, and the identification of the vision of the night with the more or less related events of the day. In one case, an elderly lady, dreaming about events which were passing around her, became unable to distinguish between her dream-recollections and her memories of actual occurrences in her waking life. Only after frequent corrections did she become aware of her infimity, and was able to realize how closely sleep and waking had become related in her history.

As illustrative of the strength of the argument just adduced—namely, that illusion depends on the want of the necessary "links" contained in the chain of ideas forming the original event or thoughts—we may quote a case given by Dr. Abercrombie in his famous work on the "Intellectual Powers." "Walking in the street lately," says Abercrombie, "I met a lady whose face was familiar to me, but whom I could not name. I had at the same time an impression that I ought to have spoken to her, and to have inquired for some relative who had lately been my patient; but, notwithstanding repeated efforts, I could not recognize her, and passed on. Some time after, in passing along the road a few miles from town, my eye caught a cottage, to which I had been taken about six months before to see a gentleman who had been carried into it in a state of insensibility, in consequence of having been thrown from a gig. The sight of the cottage instantly recalled the accident and the gentleman who was the subject of it, and at the same instant the impression that the lady whom I had passed in the manner now mentioned was his wife. In this case no recollection was excited by the sight of the lady, even after repeated and anxious attempts; and I believe I should not have recognized the patient himself had he been along with her, whereas the whole was recalled in an instant by the sight of the cottage."

In this case, as the "cottage" was the first or primary "link" in the chain, and as the lady was an intermediate "link" in the series of circumstances forming the memory, it is by no means wonderful that Dr. Abercrombie's memory refused to perform its work until the initial step in the process was reached. Once attained, this primary stage leads naturally to the others; and it is also tolerably certain that had the circumstances not been resolved into facts, as related, the mere sight of the lady would have been liable to have been classed—standing as it did in the light of a solitary fact—as an "illusion." So far from being "illusions," the cases so classified are merely

instances in which our minds fail to reconstruct the original chain of ideas or facts as these occurred in our past waking experience.

THE IMPROVEMENT OF THE MEMORY.

Naturally enough, the topic of memory-improvement forms the end and focus of all thoughts, reflections, and considerations regarding the recollective powers. Of all complaints of body and mind, that of a "bad memory" is perhaps the most commonly bewailed. The only surprising part of the practice in question appears to consist in the fact that, despite the avowal that the memory is deficient in exactitude, there is often illustrated an utter carelessness respecting its improvement. This indisposition to better the memory powers arises, I believe, chiefly from the idea that the recollective powers are little, if at all, susceptible of cultivation, education, or improvement. People, as a rule, are content to jog on their accustomed way, feeling their memory deficiencies acutely, and regretting their inability to "remember" the details of business or life at large; but, at the same time, making no effort whatever to bestir themselves in the matter of improvement. The idea that a bad memory "comes by nature," and is insusceptible of improvement, has become fixed in the minds of the majority of persons. Until this exceedingly false notion is removed and replaced by the true idea—namely that, under ordinary circumstances, the memory may be wonderfully improved and cultivated—mental progress will be retarded, and intellectual growth fail to reach even a moderate degree of possible development.

One of the points most necessary of recognition and re-

membrance in connection with the memory and its culture, is that which insists on the mutual interdependence of memory upon the bodily state and physical organization. In this respect, memory does not stand alone. Like every other mental trait, the memory shares under ordinary circumstances, the health of the frame which owns it. There is a material basis of healthy mind, apart from all considerations of metaphysical kind, in healthy brain-structure, in pure blood, fresh air, and well-nourished nervous tissue. This much no one may deny. Hence, one prolific cause of some memory-ailments of very frequent occurrence, is simply bodily ill-health. Ordinary and slight ailments of body, loss of tone, weariness, fatigue, and especially overwork, are each and all powerful causes of memory-weakness.

The class of subjects who most frequently exhibit memory-weakness from these causes, are undoubtedly professional men. The busy lawyer, doctor, clergyman, teacher, or the worried merchant, are especially liable to failure of recollective power from ordinary ailments of body. And amongst such ailments, *overwork* is perhaps, in its turn, the most common. The tired and jaded brain will, in time, refuse to exert itself. The effort to recollect becomes even painful. The pen of the journalist, in such circumstances, pauses in the endeavour to recollect appropriate words, terms, and expressions, which, at other times, and in the healthy state, literally flow from his brain. The doctor forgets the details of the cases he sees; his patients have to remind him, greatly to his disgust, of directions and orders he formerly gave. The clergyman or lecturer fails to hit the continuity of thought necessary for fluent expression. The lawyer cannot easily piece together the details which form his "case," and so on.

The memory-troubles which are most common and most troublesome are really the offspring of overwork, mental lassitude, or bodily ailments of commonplace kind; and it

should be borne in mind that such memory-troubles are not the least important, because they arise from well-known causes. On the contrary, it is because they are often readily recovered from, that they are apt to be neglected, and it is because they are apt by frequent repetition to grow in intensity that they demand special notice here.

Sir Henry Holland has placed on record a highly illustrative example of the effects of over-exertion on the recollective powers. He descended in one day two very deep mines in the Hartz Mountains, remaining underground for some hours in each mine. "While in the second mine," says the author, "and exhausted both from fatigue and inanition, I felt the utter impossibility of talking longer with the German inspector who accompanied me. Every German word and phrase deserted my recollection, and it was not until I had taken food and wine, and been some time at rest, that I regained them again." Now, in this case it is evident there was loss of memory from sheer physical exhaustion, the case being that of a highly-cultured man. What was seen in an extreme degree in Sir Henry Holland occurs frequently, in a less marked degree, in the subjects of overwork and loss of nervous and bodily tone at large. It is not uncommon to find examples of the same kind in the young. In school children, over-anxious as regards their work, and especially in those preparing for examinations and competitions, loss of memory from combined over-exertion and inattention to bodily nourishment is only too well known. The boy or girl who is so eager to learn, that meal-times and play are together regarded as unwelcome occurrences in the day's round of duties, is a subject who deserves careful, and even stern, parental treatment. These are the subjects who, crammed to repletion with knowledge, often well enough digested, and by no means gained by rote, find their memories fail them, for the simplest matters, at the examination-table ; and these are precisely the cases in which absolute rest, attention to diet and digestion, with perhaps the addition of

a simple tonic, suffice to restore the mental powers to their wonted activity.

I have frequently known cases of students, who, under circumstances similar to those above described, have "burned the midnight oil" successfully enough as regards the acquirement of knowledge, but unsuccessfully as regards their mental health. On appearing at the examination-table, and on being questioned by the examiner concerning the simplest and most trivial details, they stumble, hesitate, and finally break down. In such cases the examiner's duty becomes clear, and personally I have frequently acted upon this rule with unvarying success—namely, to request the student to return home, to eschew books and studies entirely for the day and night, and to return to the examination-hall after twenty-four hours complete rest of body and mind. The candidate reappears refreshed and eager for his trial, and finds no difficulty in satisfactorily answering questions of which the day before he had lost all cognizance. The case of the wearied child at the close of a long day spent in a heated, and often ill-ventilated school-room, is precisely similar. The teacher may threaten as he likes, no result is produced—save, perhaps, that of tears. The child's physical nature is exhausted, overstrained, and weary; and a scamper in the fresh air, with no thought of lessons, is, in such cases, the only medicine of any avail in restoring the jaded powers of mind.

The more clearly the interdependence of body and mind is discerned, the less surprised or astonished will we feel on learning, by experience of our own state or by that of others, the immense harm which physical overstrain effects in the case of the recollective powers. It might be added that failure of the memory-powers in the ordinary individual, is frequently the first sign and symptom of that overwork and loss of tone which demands rest as its sovereign remedy.

The business man or professional man, who begins to notice memory-failure in his own case, usually observes also that he is

clear-headed each morning, after the rest of the night, but fails as the day wears on. These indications, neglected month by month, it may be, result in memory-disorganization. Brain, like body, is long-suffering enough, but there is a limit to the endurance of both. Hence, when the memory fails in the active individual, he should seek rest. The sea-breezes, or the mountain-side should allure him from his desk, or study; and the quiet, which, if wise, he will seek, will be found the only safe and effective means of restoring those powers which are our willing servants,—so long, indeed, as we treat them reasonably and well.

THE NATURE OF THE MEMORY.

In my last paper I directed attention to the high importance of noting the fact that the memory under ordinary circumstances is dependent on the bodily health, and is influenced in a very striking way by various bodily conditions, among which over-work and "loss of tone," are the most familiar. It is true, of course, that in certain individuals, bodily illness may only serve to stimulate the mental powers. There are cases on record in which prodigious mental feats, accomplished in the way of memory-exercises, as well as in other mental directions, have characterized men and woman labouring under severe illness. But such instances of mental action are, at the best, exceptional in their nature. They form the exceptions which go to prove the truth of the rule. Commonly, bodily illness and languor, an overdose of alcohol or tobacco, or other excess, acts injuriously on the memory and on the other mental powers, and for a time incapacitates the subjects of the excess from the normal, and certainly from the healthy, exercise of his mind-powers.

Various correspondents have forwarded for my perusal details of extraordinary feats of memory on the part of themselves or

their friends. While thanking the writers of these communications, I may only add that most of the instances they adduce have been frequently paralleled, not only in modern, but in classic times. There are individuals who, after hearing a poem once repeated, will correctly recite the piece. Seneca mentions a case in which a man who, hearing a poet recite a new poem, in his turn repeated the verse after an interval, and claimed it as his own production; the author, of course—better poet, perchance, than "memorizer"—failing to emulate the example of the plagiarist. When Voltaire came to the King of Prussia to read a new poem of considerable length, an Englishman, noted for his prodigious memory, was placed behind a screen, within hearing of the reader. The listener, after one hearing of the production, was able to repeat the poem perfectly from beginning to end. Themistocles was said to possess the power of naming all the citizens of Athens. Cyrus is alleged to have had the power of recognizing and naming every soldier in his army. Such examples, real or exaggerated, are not without their parallel in our own day, among all ranks and classes of society, but they constitute examples rather of abnormal than of natural memory. The ordinary mortal need never envy or emulate such prodigious powers of remembrance. It is sufficient for the vast majority of educated persons that they are able to perfectly utilize their memories for the full and perfect execution and performance of the ordinary duties of life. And it is to this useful and practical end that the efforts towards memory-improvement should be directed. We desire, not phenomenal powers of memory, but powers and abilities which shall stand us in good stead in every walk of life.

One point which is, I am convinced, of extreme importance, in the culture of memory is connected with the habit of forming what may be called ordinary and useful "associations" or groups of thoughts. A striking feature of "memory," ordinarily studied, is the fact that by linking the idea we desire to be recalled to another idea, or series, the original idea is readily

reproduced. What is the meaning of this peculiarity of the human mind? Why, it may be asked, should associations and "links" serve a useful purpose in the remembrance of facts and ideas? Why is it that by affiliating one idea to another, both may be remembered, whereas, set in solitary state in the mental domain, or left unconnected, both are forgotten? In well-nigh every system of memory-training such associations have formed a notable feature. The schoolboy who cannot recollect 1815 as the date of Waterloo will remember the date by thinking of "water" and "15." The ancient Roman who turned the stone of his ring inwards towards the palm of his hand, that it might remind him of something he desired to bear in remembrance, illustrated this principle of "association." The person who, in the familiar practice of mnemonics, ties a knot on his handkerchief, in his own way exemplifies the same habit—although, as the joke goes, a second knot is occasionally needed to bring to mind the reason of the first.

In the light of these queries, an interesting speculation is opened up concerning the nature of memory. It would seem as if the memory-field of the brain, resembled the ocean surface in respect of its smooth nature, destitute of the slightest clue or indication of direction, extent, or limitation. A single mark means nothing in the waste of waters, just as a detached light may only confuse the sailor at night and lead him astray. But the relations of various lights or land-marks, and the connection which becomes evident when several marks are brought into relation with one another, serve to render clear the way of the "trackless deep." So is it, I conceive, with the memory powers, and so it is with the material basis of brain on which memory operates, and within which, all its operations are carried on. The connected series of facts, ideas, or recollections, serves, like the mariner's set of guides, to show the mental way clearly enough, where the isolated or detached light or mark fails. The "memory-links" we familiarly use, serve a like purpose, because, in the nature of things mental, our life and

thoughts present us with a connected series of facts, and not with isolated and separated ideas.

But we may find support for this argument in a consideration of the physical structure of the brain itself. It is the outer layer of the organ of mind, which is the active, working part of the great central nervous centre. This outer layer of the *cerebrum* (or "greater brain"), consists of *grey matter.* It is the layer in which the *nerve-cells* are situated. These cells, wherever found, whether in jelly-fish or man, are to the nervous system what the batteries or cells are to the telegraph system. They are the storehouses, the manufactories, of the nerve-energy, which, liberated in various directions, speeds along nerves to stimulate, here a muscle, there a gland, and there a blood-vessel. The nerves themselves, are mere "conductors" of this curious "nerve-force." It is in the "nerve cells" that the force is generated, produced, and stored.

The nerve-cells are thus the seat of nerve-force and of thought itself. Those of the "grey matter" which exists in the *frontal* lobes (or forehead-lobes) of the brain are probably the seat of the highest intellectual operations. It is here, probably, that the memory-powers, in common with many other mental faculties, dwell. This much, at least, is rendered probable by recent researches into localization of the functions or duties of the brain. Now, when this "grey-matter" of the brain is microscopically examined, what is found to be its structure and disposition? When the grey matter (i.e., the nerve-cells) of the frontal lobes of the brain are diseased, it is then that insanity of the most hopeless kind supervenes. We see the animal, deprived of these lobes, to become sullen and brutal, to lose all its intelligence and memory, and to become practically an automatic creature. That the seat of the recollective powers probably dwells in the forehead brain-lobes there is every reason to believe; and when the minute nerve-cells here as elsewhere, are examined, they are found to present us with a mesh-work of inconceivably intricate pattern. No one cell exists as a solitary

unit. The hundreds of thousands of nerve-cells are bound up in a delicate network, the ramifications of which are well-nigh past belief.

Hence we find, apparently, our explanation of memory, in this interesting fact of brain-structure. Memory consists of a series of associations. Facts and ideas are linked together, because the cells which store up and receive these ideas—because the material basis of "mind"—is a connected network of structural units, all bound together in closest sympathy, and all working in a harmony that baffles our furthest thought to trace or depict.

Memory, I hold, is thus aided by "links" and "associations," because the nerve-structures which operate in its practice are connected together in an intricate series. As no one nerve-cell is separate from its fellows, so no one idea may be conceived to be isolated in the mind which works through nerve-cells, from the other ideas which have been associated with it. Such thoughts I venture to suggest as the answer to the question, "Why is memory a matter of 'association,' and not one of detached ideas?"

HOW TO STRENGTHEN THE MEMORY.

In the preceding pages, I have endeavoured to show why memory was largely a matter of association or linking together of ideas. The commonplace fact that we recollect thoughts and ideas which are connected by some bond to other ideas, more readily than we can recall detached thoughts, is only explicable, I believe, only on the theory that the brain-cells which are concerned with the work of thinking form a connected series in the grey matter of the brain. Thoughts and ideas, in other words, do not exist as separate mental units, either as regards their actual occurrence or their storage in the brain-cells. It may legiti-

mately enough be held that no act of life is performed independently of some preceding act or circumstance. We are not always able to trace out the connexus of our actions and our thoughts, it is true. But it is, at the same time, a matter of tolerable certainty, that our acts of one day have been largely determined by those not of the preceding day, but probably of all preceding days of our life, and by the acts and thoughts of our inheritance from parents as well. To argue otherwise, would be to overlook the influence of heredity and parentage in the formation of character and of mental traits. And memory, I repeat, like every other intellectual portion to which a man falls heir, is, in the same fashion, a matter of links, connections, and associated thoughts. It is on some such basis, that we may explain why associations exist at all in the act of recollection, and it is on such an assumption at any rate, that the true culture of memory must be satisfactorily carried out.

A "first principle" in the education of the memory appears to consist in *the cultivation of habits of mental association as part and parcel of our daily practice of thought.* All systems of mnemonics utilize this principle of association in the culture of the recollective powers. Their aim is the endeavour to instil, by one means or another, the habit of linking together those thoughts that are naturally related. The more easily this is accomplished, the more readily does the memory become available for its work. The difference between one system of memory-education and another really lies in the more or less natural method in which the teacher seeks to group the thoughts of his pupils, and to accustom them to arrange their ideas. I may go still further, and say, that the best system of memory-training is that which succeeds in elucidating and practising the method of thought-linking which is most natural and which accords most readily with the mental habits of mankind or with the special studies of the pupil. It is the want of such a natural system of "linkage" which defeats most of the educative efforts of our day. Masses of facts

are presented to the minds of boys and girls at school, in a crude, undigested form. They are left to acquire the facts in question without the slightest attempt at making an arrangement or formulating a method of remembrance. Memory-powers are not encouraged, but the reverse, as far as I can observe, in our system of education. I say this the more freely because I have been engaged for years in the practice of science-teaching, and because I have been a daily witness of the defects of education in this respect.

As an illustration of what is meant by that natural association of thoughts which forms the beginning and end of memory-culture, I may select the following example. It is desired, say, in teaching botany, to impress on the pupil's mind the parts of a flower. As a matter of experience, science-teachers find that notwithstanding abundant demonstration and repetition of names, the facts taught are forgotten within a few days or even hours after the lesson. The pupil having been shown the parts of the flower, having heard them named, having named them himself, and having written them down in his note-book, might be regarded as fully supplied by eyes, ears, and intellect with the knowledge it is desired he should remember. Yet, on being questioned next day respecting his lesson, his mind is often a blank regarding a full half of the facts he was taught. The reason of the teacher's disappointment is not far to seek. The facts were supplied to the pupil without any attempt at associating them. Even in "learning" the multiplication-table there is association of numbers, so often repeated, that the mere rhythm of the table fixes the details on the mind; but in the botanical lesson, and with all its demonstration of the objects with which it deals, there has been no affiliation or "linkage" of ideas.

In the practice of teaching, it is easy, I think, to better this state of matters. I have found, as a matter of experience, that without using any artificial stimuli to memory in the shape of links or clues, the facts presented say by a flower, may be

made to dwell permanently in the mind. Thus, suppose I am dealing with the green *calyx* of a buttercup, forming, as does this part, the outer circle of leaves in the flower. The pupil sees the five green leaves, he calls them *sepals*, and he knows they form the *calyx*. Now, if I allow him to think of *calyx* alone, or of *sepals* alone, I feel tolerably certain he will not recollect one or other—in all probability, he may forget both. But if I insist on his never thinking of one (*calyx*) without at the same time thinking of the other (*sepals*), I am almost confident both will be remembered. So is it with other parts of the flower, and so is it with all other studies. We do not require artificial links when, as it seems to me, nature has, in the majority of cases, supplied natural links in the ordinary association of the objects we think about. If I am content to allow a pupil to think of the parts of the pistil of a flower as three separate and distinct items—*ovary*, *style*, and *stigma*—the chances are that when he desires to recollect the parts of the pistil, his memory will fail him, simply because the parts have never been associated in his mind. But if, on the other hand, he is taught from the first to think of *ovary*, *style*, and *stigma* as three connected ideas and parts, he can no more avoid remembering all three than he can think of a man as a being *minus* a head.

This natural association of thoughts serves our turn in the acquirement of the memory-powers which stand us in good stead when we gain the power of repeating poems and other compositions, involving, it may be, many hundreds of lines and ideas. As a matter of personal experience most of us know that we recollect the gist of the poem and the succession of its verses most readily, when the association of the events it describes is clearly kept in mind. I know an actor who, without possessing a good memory in the ordinary sense of that term, always appears letter perfect in his parts. His method of acquiring his part illustrates the natural memory I advocate for all. Instead of contenting himself with his part,

cut up, as usual, into the disconnected sentences which the cues of the other characters suggest, he procures the entire play, reads it over carefully, and gains a clear idea of the succession of events depicted therein. A natural association or broad outline of connected nature is thus suggested in the first place to his mind. Thereafter he studies his own part, and the detached sentences of which it consists, as that part remains in the entire book of the play. He thus strengthens the natural association of ideas which have been gained by his perusal of the entire play in the first instance. Then, having so far educated his mind in the complete production, he proceeds to con over his own detached part as usually supplied, and finds that the otherwise meaningless sentences of the "cut part," have already set in his mind into a harmonious connection, easy of remembrance. This is only another illustration of the natural method of memory, practised without the aid of links or associations other than those the subject in hand naturally supplies.

I trust the hints given in the present articles may be found useful by those who desire to cultivate the recollective powers in a rational and natural fashion. One observation, however, may be made by way of close to these papers—namely, that it may well become a matter of belief that we never actually lose recollection of whatever has been seen, heard, or otherwise conveyed to the inner chambers of the mind. The tune once heard during an operatic performance is perfectly reproduced, months or years afterwards, either spontaneously, or after the faint suggestion of a single bar. The poem casually repeated by a friend, recurs line by line long afterwards. The face and name of a person whom we met years ago flash suddenly across our mind when we are thinking least about him; and even when we cannot recollect the exact name of a person or thing we often find ourselves unconsciously thinking of the first letter or syllable of the name we wish to discover.

The mind-chambers seem to me to resemble most closely the photographer's store-room, where he keeps the negatives of his customers whose portraits he has taken. When we desire to call to remembrance any name or event relating to the past of our lives, the mental photographer is set to work seeking for the negative which was taken years ago. Now and then he stumbles upon a near approach to it, as the mind suggests the clue to the correct thought. But when the true negative is found, the thought is at once printed off therefrom, and the mental photograph received years ago is reproduced in all its primitive distinctness. The process of memory is merely one of finding the mental "negatives" of things seen and heard for their present reproduction. The difference between a good memory and a bad one merely consists in the facility with which the former arranges and finds the negatives it may require for present use.

HYDROPHOBIA: ITS NATURE, CAUSES, AND TREATMENT.

I.

A FEW years ago a scene, which, for brutality and cruelty committed under mistaken motives, could hardly have been equalled, was enacted in one of the streets of Edinburgh. In the newspapers of the following day appeared a paragraph stating that a mad dog had been destroyed in the streets of the city, and the public were accordingly put on the alert regarding the supposed advent of an epidemic of the dreaded disease. It was perfectly true that a dog had been destroyed, but it was not true that the dog was suffering from rabies, or canine madness. The words of a newspaper correspondent who wit-

nessed the butchery of an innocent animal are clear and distinct. The dog—a black retriever—comes upon the scene, pursued by a policeman. That official is accompanied by the usual retinue of message-boys and *canaille*, to whom any dog, pariah or otherwise, is an object of extreme interest, as admitting of a display of the savage traits and hunting instincts which the said urchins have possibly inherited from their far-back ancestors, and which the progress of civilization has not yet succeeded in eliminating. One of the said message-boys discharged his basket, in lieu of a nobler missile, at the retreating animal, which in hopes of safety and protection, no doubt, quietly followed two men who were walking down the street in question. Hearing the uproar, however, one of the men turned, seized the dog by the ear, and, as was perfectly natural, and, in my humble opinion, a perfectly just and legitimate reward for his interference, got bitten for his pains. The valiant flying squadron of message-boys, headed by the representative of law and order, had meanwhile arrived upon the scene. It was no stalwart man the policeman had to attack, nor even, according to his theory, no doubt, a reasonable or sensitive being. So, with a stolidity which renders one somewhat compassionate for the human beings who may fall under this particular policeman's grasp, he drew his staff, and, to use the term employed by the newspaper correspondent, "rained" down blow after blow upon the head of the defenceless animal. For five or ten minutes this sickening scene continued, we are told, in a city of culture and education. Then the dog's head was placed in a noose, and willing hands pulled one end of the rope one way, whilst equally willing hands pulled the other way, exemplifying a kind of Thuggish experiment in strangling the animal. With its head well-nigh pounded to a shapeless mass, with blood welling from its eyes, nose, and mouth, and surrounded by a crowd of savages intent on asphyxiating it, the unfortunate animal nevertheless had the impertinence to continue to exist. Elevated in the air by the efforts of the contending parties in

the work of strangulation, the policeman was seen to kick the dog in the most brutal manner, and the final act in this tragedy was wrought by a smith, who, more humane than his neighbours, struck the suffering animal with his hammer, and put an end to its sufferings. The secretary of that most admirable institution, the "Home for Lost Dogs," in a letter to the *Standard*, gave a case serving as an admirable parallel to the canine massacre just described. As a police constable was bringing a homeless pug-dog to the institution at Battersea, the animal took a fit close to the "Home." Immediately there arose the usual cry of "mad dog," and an excited crowd advocated the destruction of the animal. Fortunately one of the officials of the "Home" appeared on the scene, and at once saw that the dog was merely suffering from a simple fit. The patient was taken home, appropriately treated, and soon recovered. The large experience of the officials of the "Home" testifies to the extreme rarity of cases of rabies in the streets. And the slaughter of many an unfortunate dog has, as regards suspected rabies, been therefore as unjustifiable as would be the sudden execution of a human being in an epileptic fit, because the *vox populi* elected to pronounce the patient hydrophobic.

Such is the history of a street-scene which is unfortunately typical of these days. The justification of the whole procedure, I apprehend, will be that of saying that the dog was mad, and was therefore a fit subject for execution. I admit that, if mad, the dog should have been killed, but I also contend that it should have been killed in a respectable and less savage and cruel fashion. Allow that the dog was mad, and of course society and the law will ratify its death—common humanity and the same law, however, demanding that it shall not be tortured. But mark the instructive sequel to the story. A local newspaper in due course informed the inhabitants, that a veterinary surgeon had prepared a report of his post-mortem examination of the large retriever dog which had been killed in the streets in the previous week. The report set forth that

"the lesions presented were not such as to lead one even to assume that the dog had suffered from rabies." This is strong and plain language, and one can only hope that the member of the police force who assaulted the innocent animal, and the wayfarers who pulled the rope, have read the veterinary surgeon's remarks, and have duly reflected on the morality of their procedure. So, after all, the slaughter of the dog was unnecessary, and was, moreover, considering the harmless character of the animal, a piece of diabolical cruelty. A recent writer remarks that boys look upon dogs as lawful objects of assault with stones and with pins ingeniously driven into pieces of wood, which are hurled, *à la* the boomerang, at dogs as they pass. Hence the ease with which the cry of "mad dog" is raised. A dog more plucky than his kind will turn upon his assailant, who decamps, and, crying "mad dog," speedily secures his own safety, a large modicum of sympathy, and the death (by torture) of his victim.

I have dwelt upon what has been termed a common street-scene that my readers may form for themselves an opinion regarding the tortures to which innocent animals are subjected by unreasoning prejudice, and also for the purpose of influencing the public at the outset of our inquiries in the cause of intelligence and humanity, as against brute ignorance and unnecessary cruelty. The advantage of the "Dogs' Home" in London was admirably illustrated by the procedure of the Glasgow authorities some time ago, when the cry of "mad dog" was raised in the commercial capital of Scotland. Every dog not provided with a muzzle and the name of the owner, was seized by the police, detained for a short time by the authorities, and if not claimed at the expiry of the allotted period was destroyed. Hundreds of valuable dogs were thus either sacrificed or were placed in extreme danger of their lives, and without, in the vast majority of cases, the slightest pretext for the slaughter. Such a procedure exemplified with a vengeance the apothegm that "prevention is better than cure." Only, the proverb

might have been just as forcibly illustrated by the establishment of a temporary "Home" for the reception of the perfectly healthy stray dogs, whose owners would be only too glad, I imagine, to contribute to the support of the institution in consideration of the safe return of their pets. In what follows I may be able to show that the subject of hydrophobia is one concerning which much misconception exists, and regarding which much needless alarm is yearly caused. The leading features of the malady, its nature, and the modes of prevention and cure which modern authorities agree in recommending and using, may also be duly noted.

II.

To begin with, there is no hesitation in ranking *hydrophobia* as a *specific* disease, induced and propagated in man, by inoculation with the saliva of a dog afflicted with *rabies* or canine madness. In other words, the changes produced in the saliva of a dog afflicted with the canine disease known as *rabies*, render that fluid capable, when introduced into the blood circulation of a human being, of inducing the symptoms of *hydrophobia.* Rabies is essentially a distinct disease from hydrophobia. The latter originates from the former. "Rabies in the *dog*," says Sir Thomas Watson, "is quite different and distinct from hydrophobia in the *man*." The "rabid" dog is never hydrophobic. When a rabid or "mad" dog bites another dog, rabies is produced in the latter. Rabies propagates rabies, in other words. So far as is certainly known, hydrophobia, the human disease, does not reproduce itself; although some authors believe that the bite of a hydrophobic man will produce that disease in another person. Youatt was of this latter opinion. An experiment was performed at the Hôtel Dieu in Paris, in which two healthy dogs were inoculated on June 19, 1813, with the saliva of a hydrophobic man, who died on that day. On July 27 one of the dogs became rabid. Other dogs bitten

by this dog developed rabies. The only difficulty in this case, which otherwise appears conclusive, is the question of the exact origin of the disease in the first or inoculated dog. At least, this experiment should render the treatment of a hydrophobic man a matter of care in so far as his saliva is concerned.

That the virus or poison contained in the saliva of the dog is in reality the exciting cause of hydrophobia appears to be an unquestionable fact. Persons who are bitten by dogs in a state of health never suffer from hydrophobia, and it need hardly be remarked that the disease has never been known to arise independently of the bite of a diseased animal, usually a dog—but, according to some authorities, occasionally the cat; whilst, as alleged in the historical case of the grandfather of the present Duke of Richmond, the saliva of the fox may serve as a medium for the generation of the virus. This latter case, however, appears to present some elements of doubt. According to the usual account, death was caused in Canada by the bite of a tame fox, which the Duke was endeavouring to separate from a pet dog with which it was fighting. Another account alleges that the bite was inflicted by the dog. But the case, although apparently of undetermined nature as to the exact origin of the poisonous matter, need not be regarded as presenting any very exceptional elements; since the occurrence of hydrophobia in other carnivorous animals besides dogs, would form no unusual feature, but, on the contrary, would be regarded as perfectly natural, viewed in the light of other facts relative to the distribution of disease.

The probability that other carnivorous animals are affected by hydrophobia, and that they may communicate the disease to man, is supported by cases in which innoculation from the fox has been clearly proved. Cases are also given in which the bite of a racoon has caused this disease, Dr. Russell, of Massachusetts, having recorded such an instance in 1856. The badger, another carnivorous neighbour of the dog, has, according to Youatt, produced symptoms of the disorder. The bite of the

horse has been also credited with its production. Youatt mentions one case of this kind, in which a groom exhibited hydrophobic symptoms after receiving a slight scratch from a horse's tooth. That the saliva of the horse may prove a medium of infection in man is by no means unlikely, when it is considered that from this animal man may be infected with another disease, namely, "glanders," which fully equals hydrophobia in its serious effects on the human frame. The *scratch* of a cat is said to have caused hydrophobia; but, if this result accrued from a scratch, it is most likely that the animal had really derived the poison from its mouth, and had thus inoculated the disease. It is clearly to the saliva of the mouth that we must look for the origin of the disease. The poison of hydrophobia is, therefore, clearly to be ranked in the category of "blood-poisons," or those which produce their effects only when they are introduced directly into the circulation, and when thus mingled with the vital stream. As examples of poisons which also act in this way may be cited the virus of serpents, or the matter derived from decomposing human tissues in a dissecting-room or post-mortem theatre. The former is introduced into the circulation by the poison-fang of the reptile, the other on the point of a scalpel or needle.

One very remarkable feature in the action of these animal or blood poisons is that involved in the fact that they may be swallowed, as a rule, with impunity. An ounce of serpent-poison, one drop of which would produce death if introduced into the circulation through a break in the skin, might be fearlessly swallowed—provided, of course, that the lining membrane of the mouth and stomach was perfectly intact. As may readily enough be understood, the changes, chemical and otherwise, which the virus undergoes in the mouth and stomach, render it innocuous, and, when duly absorbed from the digestive system, the poison-matter will enter the circulation in an altered and harmless form. The facts just related, even when viewed apart from their connection with the present subject, are singularly

interesting as demonstrating the peculiarity of the conditions, in virtue of which a substance so deadly, when placed in one situation, becomes harmless when introduced into the organism through another channel.

Various writers have pointed out, however, that it is possible that the poison of rabies may be absorbed into the circulation—even through the sound mucous (or lining) membrane of the lips, mouth, &c. Mr. Youatt was very firmly convinced of the correctness of the belief that the saliva of a rabid animal could not infect a man through the healthy and unbroken skin; but he also believed that, if the canine saliva were brought in contact with the mucous membrane of the mouth or elsewhere, hydrophobia might follow. His own hands, he added, had many times been covered with the saliva of mad dogs without any result following the application. A man on one occasion used his teeth to untie a knot in a rope. Eight weeks afterwards, he died from hydrophobia. The case was explained on the ground of a mad dog having been tied up with the rope in question. In another case a mad dog tore a woman's gown. In sewing the gown she pressed the seem with her teeth, and in this case, also, death from hydrophobia supervened—presumably from the lips being infected from the gown. Cases are recorded in which horses have died of rabies after eating straw on which rabid pigs died. Two dogs licked the mouth of a rabid dog, and died from rabies in eight days thereafter. Dr. Perceval gives a case in which a mad dog licked the face of a man who was asleep. The man died of the dreaded disease; but examination failed to discover any cut or chap in the skin through which the poison could have been absorbed. "These facts," says Sir Thomas Watson, "if authentic, settle the question; unless, indeed, the lips of those who perished happened to have been chapped or abraded."

The tissue of errors with which the entire subject is surrounded may be said to include the erroneous designation of the disease as far as the dog is concerned, since the term "hydrophobia" literally implies a dread of water, and the popular idea

of the chief symptom in the disease is that of the afflicted—and, properly named, the "rabid"—animal flying from the very presence of that liquid. This idea is utterly erroneous. So far from shunning water, a "mad" dog will immerse itself in the liquid, and endeavour to drink—an act which, however, the animal is unable to perform owing to the paralyzed condition of the jaws, and from the consequent inability to swallow liquid of any kind. So also the term "rabies," indicating, according to popular notions, a state of violent fury and madness, is a misnomer as far as the dog is concerned; indeed, maniacal excitement on the part of the animal is rather the exception than the rule. As a description of the symptoms of rabies in the dog is not only a very necessary item in an article devoted to the consideration of the subject of hydrophobia, but is calculated to be of useful nature, the invasion and course of the disorder may be noticed at the present stage of our inquiries. Certain premonitory symptoms appear to mark the invasion of the disease, these indications being best marked in changes in the habits and disposition of the animal The temper becomes sullen. The animal is restless and fidgetty, and is continually gnawing or scratching some portion of his frame. Soon the symptoms of depraved appetite begin to be observed. The animal picks up and eats all kinds of odd substances, and it may be noted that presumptive evidence of the disease having existed may be found in the fact that the stomach on *post-mortem* examination is found to contain a miscellaneous assortment of articles which the dog has swallowed. Saliva begins to flow from the mouth, and distressing symptoms, connected no doubt with difficulty in breathing and the accumulation of viscid mucous in the mouth, begin to be apparent. One very noticeable symptom is the continual working at the mouth with the paws, as if the animal were endeavouring to remove something entangled between the teeth. Paralysis of the lower jaw next sets in, and is succeeded by general paralysis of the limbs, culminating in the fall of the animal. The breathing becomes laboured and heavy; the bark is short, sharp, and

unnatural; and, with the occurrence of graver nervous symptoms in the form of convulsions, the animal dies at a period varying from the fourth to the sixth, or even the seventh day of the disorder.

III.

By way of comparison with rabies in the dog, the symptoms of hydrophobia in man may be briefly detailed. Here the application of the term "hydrophobia" is in the man correct enough, for the human patient has a very distinct horror of fluids. After a period of larger or shorter duration—to be more particularly referred to presently—and which may be denominated the period of "incubation," the person who has been bitten by the rabid dog exhibits symptoms of mental and general nervous irritability. After a lapse of one, two, or three days marked by these symptoms, true or active indications of hydrophobia begin to appear. Fever is present, there is difficulty of respiration, and spasmodic twitchings of the jaw-muscles, a horror of liquids, and a complete inability, notwithstanding extreme eagerness, to swallow fluids, are notable symptoms. The slightest sound or touch excites the patient; mental aberration and delirium supervene; general paralysis usually accompanies the delirium; and, after an increased aggravation of all of these symptoms, death occurs as a welcome termination to an existence embittered almost beyond description. Death may occur within twenty-four hours after the appearance of the more active symptoms; but a fatal issue may be delayed until the second or third day. Sometimes, however, death may be preceded by a period of comparative repose, life ending in such cases without a struggle.

One of the most unaccountable features of this disorder has long been recognized in the varying periods of *incub tion*, which intervene between the reception of the poison of hydrophobia and the manifestation of the symptoms of the disorder. The fact is one of the best known regarding the disease, and it

is not without its due and often serious effect on the popular mind. For, as may readily be supposed, a person once bitten by a dog which has been rightly or wrongly supposed to have been rabid is regarded, through the belief in a long period of incubation or latency of the disease, as a doomed man. With a sure and fixed idea regarding the eventual appearance of the symptoms, and with the knowledge that the disease *may* manifest itself after the lapse of a long interval between the bite and the occurrence of active symptoms, the unfortunate individual may be said to live with a veritable sword of Damocles suspended over his head. As we shall afterwards note, a person who has been bitten by a hydrophobic dog is by no means to be regarded as a patient either certain of death or hopeless of cure. One very important effect of the common belief, in the invariable occurrence of hydrophobia after the bite of a rabid dog, is that of inducing a nervous horror of the disease, and of inciting a mental state which unquestionably predisposes to the exhibition of its symptoms.

A belief no less erroneous and injurious than the preceding, is that which maintains that a person bitten by a perfectly healthy dog will become hydrophobic if the dog should subsequently become rabid. That this belief is absolutely without foundation is a conclusion which can be readily arrived at from the exercise of a little common sense, apart from scientific knowledge. Cases in which the bite of a dog, alleged to have been perfectly healthy, has produced symptoms of hydrophobia, will probably be found to present evidence that the dog has not been wholly free from indications of canine madness. Indeed, as every investigator into this matter well knows, even a case which at first presents him with the plainest record of circumstances, will be found on closer examination to require both time and trouble to procure exact evidence of the state of the dog—that is, evidence which will satisfy the demand for accuracy on the part of the scientific observer.

The fact, however, that a longer or shorter period of

inactivity of the poisonous principle, or a period of "incubation," as we have termed it, intervenes between the bite and the occurrence of active symptoms of hydrophobia, is indicative of the specific nature of the disease. In all disorders arising from the exhibition and development of a special poison within the living body, a latent period occurs. During this period the virus may be supposed to develop its strength and characteristic properties. Assuming that the poisonous material is analogous in its nature—as most physicians now regard the *materies morbi* of specific diseases to be—to low forms of animal or plant life, we may readily explain the occurrence of a period of incubation by a reference to the phenomenon of development, and by supposing that the specific organisms contained within the poison, require a certain period to accommodate themselves to their surroundings.

A drop of yeast introduced into a sugary solution contains a few *torulæ* or yeast-plants. After an interval, the action of fermentation begins within the solution; and we explain the interval that elapses and the ensuing and characteristic action that commences, by saying that the original and introduced plants have been developing others in immense numbers, and that only when enough yeast-plants have been produced does the fermentative action begin to be plainly exhibited. When a minute quantity of vaccine matter is introduced on the point of the physician's lancet through an abrasion of the skin into the blood-circulation of the infant, a latent period ensues. For hours no alteration beyond a certain redness of the arm can be detected. But by-and-by, the indications of the mild fever which is to protect the child against the more formidable small-pox, begin to be both locally and constitutionally manifested. The seat of the operation exhibits indications of a very characteristic action, whilst the constitution generally participates in, and sympathizes with, the effects which at first were locally produced. In this latter case, as in that of the production of fermentation by yeast, we

assume that the minute particles of the vaccine matter, like living organisms—they probably are such—requiring time to accommodate themselves to their new surroundings within the body, and that when they had become sufficiently developed, their characteristic effects were made apparent.

In the light of such knowledge, we can readily imagine that the poison of rabies, when introduced into the blood-circulation of man in the saliva of the dog, requires a longer or shorter period—the period of incubation—for the full development of its powers, and for the exhibition of active indications of its presence. The periods of incubation which the hydrophobic poison appears to exhibit vary from a few days to one, two, or three months. But the most notable point regarding the case before us, as already remarked, consists in the *varying duration of the periods of incubation* through which the virus may pass both in the case of man and of the dog. A case is known in which a rabid dog bit several members of his pack. Six of the bitten dogs developed rabies. They were all bitten on June 8, but they sickened and became "mad" after 23, 56, 67, 81, 155, and 183 days respectively. Exceptional cases, on the side of shortness of the period of incubation, are recorded, in which active symptoms set in on the eighth day after the injury. On the side of prolonged periods of incubation there are well-authenticated cases which show that symptoms of the disorder may intervene after four, five, seven, and even twelve years. Dr. Bardsley, in "Medical Reports of Cases and Experiments" (London, 1807), relates a case in which, apparently, the last-named period intervened between the bite and the appearance of symptoms of hydrophobia. Mr. Hawkins tells us that out of 130 cases, five-sixths developed the disease between eighteen days and three months. From the *Lancet* we gleam particulars of a very instructive case, communicated by Mr. Rigden, of Canterbury, in which two patients were bitten at the same time by a rabid cat—this animal having been infected through the bite of a rabid dog. The symptoms in the one

patient occurred two weeks before they appeared in the other, notwithstanding the correspondence in the date of the infection. In the *Lancet* for 1829, a Dr. Elliotson relates that two little girls were bitten at the same time and by the same dog. The child who was the second to be attacked by the animal became hydrophobic and died. Her sister experienced all the premonitory symptoms at the same time, but recovered completely. Of 21 persons who were bitten by a rabid dog, according to John Hunter's account, only one suffered from hydrophobia; and of 17 persons who were bitten by a mad wolf, 10 died. In another case, of similar nature to the last, in which 23 were bitten, 13 died.

Sir William Gull had a case, in which hydrophobia supervened after a five years' period of incubation. A person bitten by a dog became hydrophobic seven years afterwards; for 25 months before his seizure he was confined in jail as an ordinary prisoner. He had a well-marked scar as the result of the bite. With regard to the general period of incubation, statistics show, as has just been noted, that the normal length of the period in man extends at most to a few weeks. Eighteen days may be deemed a short, and three months an extended period of incubation, judging the length of this period by a normal standard.

Records of experimentation on dogs support the idea that the latent stage is by no means of long duration. M. Renault published in 1862 the results of a series of experiments, in which dogs were infected with rabies through exposure to the bite of animals suffering from the malady; 131 dogs in these experiments being bitten by rabid dogs, or inoculated with the saliva of their rabid companions. Of this number, 63 exhibited no symptons whatever at the end of four months. In the remaining 68 rabies appeared. The shortest interval between the period of infection and the occurrence of active symptoms was five days, the longest interval being 120 days. In 25 of the 68 dogs, rabies set in between the 5th and 30th day, in 31 dogs between the 30th and 60th day, in 7

between the 60th and 90th day, and in 5 between the 90th and 120th day. Thus a period of latency extending from the 30th to the 60th day was by these experiments shown to be that which was most frequently represented in the dog. Other observations show like variations in this period in the case of the dog.

IV.

What explanation, it may be asked, can be afforded of the long-delayed appearance of hydrophobia? The only answer which can be given to this question is that which refers the cause to the detention and storage, so to speak, of the poison at the seat of infection, namely, the wound. This view is homologated by Pasteur's latest researches. The subsequent liberation into the system of the poison produces the disease. The lesson to be drawn from this belief is that which inculcates the duty of destroying the virus, fully and completely, by cauterization or otherwise, on receipt of the injury. Parallel cases are not unknown in medicine which seem to point to the storage of matter capable of producing after-effects. A child duly vaccinated has been known to develop the vaccine-pustule a year after the operation. A little girl of fourteen, developed vaccine-spots from the point in which she had been vaccinated *when an infant*; her elder sister being re-vaccinated from these long-delayed vesicles. In such cases as these the vaccine-matter must have been locally stored up, and must have been called into activity by some circumstance favouring its liberation into the blood at large.

Can any explanation be afforded of the variations in the period of incubation in man and in lower animals? To this question only a very qualified answer can be returned, although, at the same time, the circumstances of hydrophobic infection and of its variations in respect of its development can be readily shown to relate themselves to the phenomena exhibited by other specific diseases. A period of incubation has been

already shown to be a perfectly natural occurrence in such diseases. That the period of incubation in fevers and other disorders varies according to the age, constitution, sex, and temperament, and state of health of the patient, is a fact admitting of no dispute. Mr. Rigden's case, and that of Dr. Elliotson, already quoted, is susceptible of explanation only on the latter hypothesis. And in the case of the experiments on dogs, it is highly probable that differences in the breed of dogs, and in their constitutional peculiarities, determine in favour of or against the speedy occurrence of the symptoms of hydrophobia. There are well-known instances of human beings who exhibit a special liability to the attack of certain disorders, and of others again who seem to pass scatheless under circumstances of the most trying kind. There are also certain races which, as a whole, escape the attack of diseases to which other races are subject—these facts pointing to peculiarities of constitution in the individual, or in the race, as the cause of susceptibility to or immunity from disease. And so we may imagine the advent of hydrophobia and rabies in man and in lower animals may be influenced, either as regards the shortness or the extension of its latent period. This explanation, it is true, may be regarded as dealing more with the general principles of hydrophobic infection than with its exact *rationale.* But the science of the causation of disease has not yet advanced sufficiently far to enable us to point to the exact circumstances which favour the development or retard the growth of the virus. The field of inquiry, however, is one to which the general facts just mentioned clearly point the way.

The importance of a clear understanding of the nature and prevention of hydrophobia is made clear by the returns of the Registrar-General, in which the number of deaths from this disease are duly recorded. In 1844, Mr. Hawkins says, that he knew of only two cases of hydrophobia having been seen in the practice of St. George's Hospital, London, between that date and twenty-five years before. Many good authorities

found it hard to believe in the existence of a distinct and specific disease to which the name "hydrophobia" could legitimately be given. In 1838 we learn that 24 persons died in England of this disorder. The next year in which the disease attained a high development was 1848, when no less than 27 cases occurred. Seventeen cases are recorded as having occurred in 1849, 13 in 1850, and 25 in 1851. In the period extending from 1856 to 1866, 93 cases are recorded, and of these 93 cases, 36, or more than a third, occurred in 1866. This latter year saw the largest number of cases since the practice of registration began. The population at the middle of 1866 was estimated at 21,210,020, and about two cases of hydrophobia to each million of the population was therefore the proportion represented in that year. In the preceding year the fatal cases of hydrophobia did not show half this proportion. In 1870, as the next year after 1866 when the number of cases rose, 32 cases were recorded—1871 showing no less than 56 cases. Thirty-nine occurred in 1872; 28 in 1873; 81 in 1874; 47 in 1875; and in 1876 over 50 cases at least. In the decade ending 1875, 334 persons died in England of hydrophobia. In 1877, 16 cases are stated as having occurred in London alone, up to the end or near the end of November; but there can be little doubt that a large number of cases will have to be added to the returns for 1877. Statistics of this disease discover some remarkably curious facts relating to the persons bitten, and also to those who escape hydrophobia, although placed in circumstances of a kind likely to engender the affection. A report of the Postmaster-General contains the peculiar information that in 1876, in a large town in the north of England, twenty per cent. of his officials, or one in every five, were bitten by dogs.

What may be the conditions to determine the affinity of dogs for these northern letter-carriers is a thought left to the imagination of the reader; but for the satisfactory discussion of the matter, we should require statistics of the total number of persons bitten in the town referred to, as well as information

relative to the habits and practices of the post-office officials, and to the cases (if any) of hydrophobia which appeared, and the results of treatment. Very interesting is it to find the secretary of the Home for Lost Dogs at Battersea informing us that not a case of hydrophobia has occurred in the metropolitan police, whilst no case has occurred at the Dogs' Home within the last seventeen years. The head-keeper has been frequently bitten, and sometimes severely, and presumably by all kinds of dogs, without once suffering any inconvenience beyond the mere local pain resulting from the injury.

Statistics show us that only a certain proportion of the persons bitten by a mad dog apparently suffer from hydrophobia—a result due it may be to constitutional peculiarities, to the greater or less nervous nature and amount of the infection, or even it may be to the state of the general health prior and subsequent to the injury. Authority has stated the proportion of hydrophobia cases of those bitten at 1 in 25; but this computation is decidedly too low. Of 114 persons bitten by rabid wolves, 67 took hydrophobia. In 75 cases, the bites of dogs, it is interesting to note, were inflicted in 9 cases in the arm, in 15 on the face, in 11 on the leg, and 40 on the hand.

V.

Can the origin of hydrophobia be accounted for, and have we any definite information regarding the interval, or effects of external and physical conditions on the disorder? are queries which may appropriately be asked and answered at the present stage of our inquiries. That rabies was known to occur in the dog in classical times is well ascertained from the records of the classic scientists, but it is highly probable that the disease assumed importance in England so lately as the beginning of the present century. It was, however, well known in Europe three hundred years ago. It has never occurred in Australia,

nor in New Zealand, whilst other parts of the world in which European dogs exist, and where native dogs, or carnivora closely allied to dogs, occur, are also exempt from the malady. It is now known to exist amongst Arctic dogs, and it occurs amongst the canine races of China. Hydrophobia has never been certainly known to be produced save from the bite of a rabid dog, and the belief that hydrophobia rarely, if ever, reproduces itself, or is not capable of being communicated from one human being to another, seems, as far as our knowledge goes, placed on a basis of fact. There is, of course, no chance of witnessing the effects on the human subject of inoculation with the saliva of a hydrophobic patient; and, indeed, there is as little chance that infection in any ordinary case could be propagated from that source. The entire question of the origin of hydrophobia, therefore, turns upon the determination of the origin of the rabies in the dog. Exterminate the latter disorder, and hydrophobia would, of course, completely disappear. It cannot be said that the information which a study of the "surroundings" of rabies affords leads to the formation of any definite opinion regarding its origin. The very common notion that rabies is engendered or favoured in its development by summer heat—a belief which has given origin to the term "dog days" has been long ago proved to be utterly unfounded. Rabies appears in all seasons. Nor does the want of water produce the disorder, since experimentation on this head—cruel, but justifiable from the information it affords—has shown that a dog may die of thirst, but will not, on account of the want of water, become rabid. Want of food will not produce the disorder, neither does over-feeding act as its cause. It is more common in male dogs than in females—a fact probably explained in greater part by the greater preponderance of the male sex in the canine races. The bite of a furious or enraged but healthy dog, as already remarked, does not produce rabies in another dog, or hydrophobia in man, nor does the breed favour or discourage the disorder. Mongrels and curs are more frequently affected, simply because they are

more exposed to the attack of their rabid neighbours. And no age, lastly, is exempt from rabies, the disorder being found in very young as well as in very old dogs. These considerations lead to and strengthen the important idea of the highly *specific* nature of the disease. Many of the foregoing conditions, which of themselves are utterly incapable of *originating* rabies, will tend either to favour or retard the disease when once it has appeared.

VI.

Our papers would be incomplete without a reference to the means adopted for the prevention and cure of hydrophobia, seeing that the previous statements naturally lead up to such a conclusion. We have already indicated a very important duty —not merely on the part of the public at large, but especially on that of the police—at the outset of these remarks—that of distinguishing between a case of true rabies and where an unfortunate dog is suffering from a fit, or, what is a more common case, where a dog pursued and hunted by boys is regarded as mad. If the public have to choose between the alternatives of "mad dog" and "dog in a fit," they will be on the correct side in nine cases out of ten if they adopt the latter opinion. Rabies, after all is said and done, is not a common affection, but is one, nevertheless, which a diseased public imagination will cause to be regarded as alarmingly prevalent. Suppose, however, that a rabid dog has inflicted a wound, the main and important question of "what is best to be done" has to be answered on the spot, and, it may be, by the non-professional bystander. It argues powerfully in favour of the movement for teaching the principles of human physiology in all our schools, that the answer to this question is readily forthcoming from a consideration of the subject of the blood circulation, and of the means to be taken for preventing the diffusion of the virus through the system. The rules to be acted upon in the case

before us are those which teach us the right method of treatment in all cases in which a poison has gained admittance to the circulation. Rule first reads thus:—Prevent the diffusion of the poison through mechanical and other means. All surgeons agree in recommending immediate *excision*, i.e. the cutting out of the bitten part as the safest procedure. To this rule there can be no difficulty or hesitation in assenting, provided there be forthcoming the surgeon and his anæsthetics. By the use of the latter all pain is avoided, and the treatment thus indicated, apart from the question of pain, is that considered the most effective by all authorities. Sir Thomas Watson has a very striking and forcible passage regarding the treatment of the bite of a rabid dog:—"For my own part," says Sir Thomas, "if I had received a bite from a decidedly rabid animal upon my arm or leg, and the bite was such that the whole wound could not be cut out or thoroughly cauterized; my reason would teach me to desire, and I hope I should have fortitude enough to endure, amputation of the limb above the place of the injury."

But suppose medical aid is not forthcoming, what is then to be done by the bystander? The answer is, tie a bandage tightly *above* the wound, for the purpose of arresting the venous circulation, which is, of course, tending to diffuse the poison through the circulation. The poison should then be either destroyed by cauterization of the wound, or be removed therefrom by suction. Remembering, however, the possible risk of infection through the mucous membrane, the cupping-glass should be preferred as a means of suction. Next, try to wash away, as soon after the infliction of the wound as possible, the poisonous material. Probably the best method of attaining the latter result is that of placing the wounded part under a strong douche or stream of cold or tepid water, and of allowing the water to play with some degree of force on the wounded surface for at least an hour or longer. Thereafter, according to Mr. Youatt's belief, the safety of the

sufferer would be secured by having the wounds well cauterized with nitrate of silver (lunar caustic), a substance which, in his own hands, proved eminently successful in the treatment of dog-bites. Strong carbolic acid has lately been recommended for this purpose. There could be no objection in the treatment of dog-bite to using a red-hot coal or iron for the purpose of cauterizing the wound and destroying the poison. The actual cautery, it may be added, is by no means so painful a procedure as is commonly supposed. The common-sense rules of first and speedily adopting measures calculated to eliminate the poison from the seat of the wound, of arresting its diffusion through the blood-vessels, and thereafter of securing the further immunity of the wounded part by destroying as much of the surrounding tissues as possible, should be borne clearly in mind. Curare, the famous arrow-poison, has been employed with success in one case, and high authorities agree in recommending the use of the Turkish bath by way of assisting in the elimination of the poison. But the chief matter which concerns the public at large is that of the means to be used on the spot, the after-treatment being a matter for the especial consideration of the physician.

The conclusions regarding hydrophobia to which these remarks lead, may be summed up in the statements, firstly that it is an affection respecting which much popular misconception exists, and that in consequence a large amount of unnecessary fear and alarm prevail regarding its occurrence ; secondly, that hydrophobia is in ordinary cases a curable affection, provided prompt measures are used for its cure ; thirdly, that the phenomena of the disease point to its clearly specific nature, and to its being derived in man exclusively from the diseased secretions of rabid dogs and of allied animals ; and, lastly, that the best means for ensuring the public safety consist in the widespread knowledge of the nature of the disease and of the measures to be adopted for the prevention and cure of the disorder.

A highly important piece of final advice is that which enforces the wisdom of seeing that a dog, suspected of being rabid, and which has bitten a person, *should not be destroyed*, but should be tied up and carefully watched. If the dog is in good health and has simply bitten the person through anger, the preservation of the animal and its subsequent health will show that the case was not one of rabies, and will save the bitten person many continuous pangs of dread and fear. If, on the contrary, the dog does prove to be rabid, its seclusion will most clearly demonstrate the fact, and it can then be mercifully destroyed, whilst the patient can be attended to, and remedial measures and precautions duly observed.

"Knowledge is power" in truth, in the presence of the sudden danger which a rabid dog or a serpent's tooth, or indeed any other untoward accident, may bring. The knowledge which points the way of safety can in no case be regarded as exaggerating an evil, even although such knowledge deals with details which, to non-professional readers, may appear unpleasant, and which usually fall to be considered by the physician and surgeon along. Whilst the diffusion of technical information as a means of averting disease and death may be regarded as exemplifying "saving knowledge" of the most valuable kind.

HYDROPHOBIA AND ITS PREVENTION.

The name of Pasteur is already familiar to most of my readers. The reputation of the distinguished Frenchman as an investigator into the causes of certain grave diseases is world-wide. He has successfully solved the higher problems of disease-prevention in the cure of the splenic fever of cattle, as he long ago showed the French silk-growers the means which should be taken for the repression of their enemy the

pébrine, which decimated the silk-worms, and for a time threatened to swamp the commercial prospects of France. His latest research has been undertaken in an entirely new field—that of the prevention of *rabies* or canine madness—the disease of the dog which gives rise to the dreaded *hydrophobia* of man. The rabid dog does not, in truth, seem a hopeful subject for research, but the genius of Pasteur appears to be equal to the task of surmounting difficulties sufficient to daunt lesser minds. Rabies is, in truth, a terrible disease, whether viewed as an ailment of the dog, or relatively to its effects on man. Hence Pasteur's research, while showering benefit on the canine race, no less tends to ensure human safety from hydrophobia, which, up to the present, has been one of the most hopeless of diseases in the hands of the physician.

The starting-point of Pasteur's research is the idea that there exists a definite principle of disease, which, so far from being mythical, theoretical, or mysterious, presents itself to investigation as a material thing. It was this view of matters which, in the case of "fowl-cholera" and "splenic fever," led to such great results; and, in the case of "rabies" the same method of inquiry is being pursued. That disease, as Pasteur pointed out in the Medical Congress at Copenhagen, never arises "spontaneously"—it is never seen as the child of nothing. On the contrary, every case of dog-madness can be traced to a previous case; or must be believed, if the evidence is to be trusted, to have arisen from a preceding attack of the disease. The "mad" dog, in other words, has been infected by a mad dog; and the latter has simply transmitted to the healthy dog the disease principle which was at work within its frame. Now, as Pasteur remarked, the nature of the disease is not disputed. It attacks the dog's nervous system; it is found in the brain, spinal marrow, and nerves, although it does not seem to attack all these parts at once. It has its chief seat in the upper part of the spinal cord, or *medulla*. This is the part wherein the poison focusses itself, and it is from this part that

as Pasteur points out, we are able to obtain the diseased material for purposes of experiment. Matter taken from the top of the spinal cord of the "mad" dog, and placed or inoculated into the brain-surface of a sound animal, invariably produces the disease. Of this fact, no doubt can be entertained. The brain, in this experiment, is the soil; the poison of the disease, obtained from the nervous system of the diseased dog, is the seed; and the inoculation is merely the sowing within the healthy animal of the seeds of the disorder. This much is plain, and this much is absolutely necessary to prove two points—firstly, the nature of the disease, and, secondly, how it can be transmitted from the affected to the healthy animal.

Pasteur points out the uncertainty which attends the production of rabies in the dog. Diseases mostly show a period of hatching—incubation, as it is termed. Rabies may take four or six weeks to develop its symptoms, while, in another case, it may delay its appearance for two months. Much depends, firstly, on the amount of the poison, and, secondly, on the virulence or power of the diseased materials. But this applies to the ordinary method of infection, where a mad dog bites another. Where the poison is introduced as described into the brain of the sound dog, there is no such uncertainty. Listen to Pasteur's own words:—

"The quantity of the poison (or disease material) may be infinitesimal. On May 10th, 1882, ten drops of a fluid obtained by macerating in a prepared fluid, a portion of the spinal cord of a wandering mad dog were introduced into a vein of the leg in a healthy dog. A second dog was inoculated with one-hundreth, and another dog with two-hundreth the quantity. The first dog had rabies on the eighteenth day, and the second on the thirty-fifth day, the third was unaffected, the quantity of the virus not being sufficient. This dog was again tested, and developed 'madness' twenty-two days later. If we take mad dogs at any season, and in each case separate the special part of the spinal cord where the disease exists, and

inoculate with the material the brains of a few rabbits, the phenomena will be the same. No matter what dog be used, the madness will appear within twelve to fifteen days; it will never be eleven, ten, or eight days, though it may be over the fifteen days. Other instances of the peculiarities of the virus might be given, all proving that there exists and can be produced different kinds of rabies, all more or less violent and fatal. Guinea-pigs soon attain a maximum of virulence, the incubation period is shortened, and by transmission we obtain a virus which far surpasses in virulence that of rabies ordinarily met with."

So much for actual experiment with the diseased matter. Proceeding next to speak of the grand question of "prevention," Pasteur remarks that it has been proved that in various ways, the matter of disease can be altered, modified, or, to use his own expression, "attenuated." By "cultivating" the active and powerful germs of a disease, and by thus causing the germs to breed and multiply from one generation to another in specially-prepared fluids, we can obtain in five or six cultivations a set of germs which may be described as the weakened progeny of the first which were drawn from the diseased animal. Jenner showed that the poison of "grease" in the horse became weakened by being transmitted through cows. Could the poison of rabies in the dog be weakened—and used as a protective against the disease itself—by being "cultivated" through the bodies of other animals? was a question which next and naturally occurred to Pasteur. Here follows the record of experiments, justifiable in the extreme, simply because they had for their aim the discovery of the means of saving human life from this dreaded scourge.

"Many unsuccessful attempts were made," says Pasteur, "until in the case of monkeys a suitable medium was found. In 1883, on December 6th, the part of the spinal cord of a dog —which had bitten a child who died of hydrophobia—was taken and the brain of a monkey inoculated with it. In

eleven days the monkey became rabid. From this monkey, the virus was transmitted to a second. In eleven days, the second monkey showed signs of rabies. A third monkey became rabid in twenty-three days. Other monkeys were experimented on. With part of the spinal cord of each of these monkeys, two rabbits were inoculated. The two rabbits infected by the first monkey became rabid on the thirteenth and sixteenth days. The two inoculated from the second monkey showed the disease on the fourteenth and twentieth days. The two from the third monkey became affected on the twenty-sixth and thirtieth days; two from a fourth monkey on the twenty-eighth day in each case; and two from a fifth monkey, on the twenty-seventh day. Two from the sixth monkey became mad on the thirtieth day. By transmission from monkey to monkey, and from monkey to rabbits, the strength of the poison seemed weakened. A dog inoculated from the fifth monkey had an incubation period of not less than fifty-eight days. Other experiments confirmed these results.

"We thus found out a method of attenuating and weakening the poison-material, and discovered a method of vaccinating dogs as a protection against rabies. As a starting-point we take one of the rabbits inoculated (from monkeys) to such a degree that injection of the poison by the veins or skin does not cause death. The preventive inoculations are done with the nervous tissue of rabbits, which have been successively infected from monkeys to rabbits. This method has been tested in our laboratory. Jenner's discovery met with opposition. Remembering this, I determined to lay my results before a scientific commission. M. Tallières, Minister of Instruction in France, supported my project, and a scientific commission was appointed to examine my statements and to check the facts I had communicated to the Academy of Sciences, May 29th, 1884. M. Bouley was chosen president, Villemin, secretary.

"The committee have recently presented their report to the

Minister: I am now able to give a brief account of the results of the first report. I presented to the commission nineteen vaccinated dogs, all of which had been rendered insusceptible by preventive inoculation, and thirteen which had been further tested, after vaccination, by brain inoculation. These nineteen dogs were compared in different ways with nineteen other dogs, chosen for the purposes of experiments. Let us look at the results. The commission performed experiments on thirty-eight dogs, nineteen protected and nineteen unprotected. The commission reported that in the case of the nineteen unprotected dogs, rabies occurred as follows:—Of six bitten, rabies occurred in three; of seven inoculated in a vein, rabies in five; of five inoculated in the brain, all died. This latter method was the surest. *On the other hand, not a single symptom of rabies appeared in any of the dogs vaccinated by me and declared insusceptible.* One dog died from diarrhœa; the cause of death was verified by post-mortem examination and by tests. Three rabbits and one guinea-pig were inoculated from this dog, but all these animals are in the best of health, and are still under observation. The commission are continuing their experiments, and will present a further report."[1]

Thus, at the present time, we see how, as the result of experiment, we are able to possess hopes of the strongest kind that rabies and hydrophobia may be diseases which, at no distant future, will be under the command of science. The search for the knowledge that is to protect us against disease often leads us through the pathways of pain; but, when the pain of lower life contributes to the safety of human existence, we may not, if we could, stay the hand of science from giving us security against disease, and safety from the "grim shadow" itself.

[1] Since the above papers were written, M. Pasteur has further and successfully elaborated his experiments, and has carried them into practical effect in the treatment of many cases in which persons have been bitten by rabid dogs and wolves.

THE "GERM THEORY" OF DISEASE.

I.

THE "Germ Theory" has become a household word amongst us. Persons unfamiliar with science in any of its aspects, know at least something of this theory, and of the objects it seeks to attain and to explain through its tenets. The vast importance to all—gentle and simple alike—of a knowledge of how diseases are produced and generated, whence epidemics come, how they grow and spread, and how they may be prevented, is, of course, self-evident. There is at the same time a crying need that the people should have explained to them the nature of the theory which lies at the root of the modern treatment of infectious diseases, and which forms the foundation of our efforts to arrest and stamp out these disorders. It may be premised at the outset that the scientific and medical world is by no means agreed as to the truth of the "germ theory." In common fairness to a few distinguished physicians and surgeons, this latter fact must be mentioned. They prefer to assume that infectious diseases are produced by a chemical and allied condition rather than by the growth of *living particles* or "germs." The question is, therefore, for certain scientists, still an open one; but it must also be added that the majority of scientific men—physicians, surgeons, naturalists, and physicists—have accepted the "germ theory" as not only a thoroughly consistent one, but as that which alone explains all the circumstances connected with the propagation and special characters of infectious disorders.

It is asserting a truism to say that an historical review of the growth of an opinion or theory is by far the most lucid fashion of arriving at a true estimate of its worth. Hence we propose in the present instance to trace the rise of the "germ theory," and to show how this idea of the *living origin* of disease has come to find a prominent place in the annals of our time.

Dr. T. Maclagan, in his "Germ Theory of Disease," says,

"This theory is, that many diseases are due to the presence and propagation in the system of the minute organisms (i.e., living beings) having no part or share in its normal economy. This it is, and no more. It is essential to be clear on this point, for the opponents of the germ theory, and to some extent its advocates also, have introduced into the discussion of that theory the question of the source and mode of origin of these organisms—a complication which has tended to hamper men's minds, and to divert attention from the real subject of discussion, THE COMPETENCE OF GERMS TO PRODUCE THE PHENOMENA OF DISEASE." The latter words, emphasized by Dr. Maclagan, contain the gist of the theory, which may fairly be said to have originated some two hundred odd years ago, in the city of Florence. In 1668, one Francesco Redi, physician to the Grand Dukes Ferdinand II. and Cosmo III., of Tuscany, found himself at variance with the scientific thought of his day, when he asserted that maggots in meat were produced, not by the decay of the meat (i.e., without parents, and from dead matter), but from the eggs laid in the meat by the flesh flies. It must be remembered that the belief that living beings could arise from dead matter, without the existence or need of parents, was a stable belief of the ancients. Mould in decaying meat and fruits, eels in mud, and even frogs in the ponds, were believed to be bred somehow, from the lifeless matter around. "The corruption of one thing, is the birth of another," so said the ancients; and Lucretius, in a well-known passage, tells us that "many living beings, even now, spring out of the earth, developed in rain-water, and in the heated vapours raised by the sun." Therefore, Francesco Redi, like many another reformer, found that he had to do battle with a long-established belief, whose overthrow was by no means to be lightly accomplished.

In the battle of one theory against another, facts are the only weapons which do yeoman service in the hands of the contending sides. It was not wonderful, therefore, that Redi should proceed to marshal his facts against the "spontaneous gene-

ration" idea—for by this name may be indicated the belief in the development of living beings from dead matter. He took some meat, placed it in a jar which he covered with paper, and showed that whilst the meat-corruption went on as before, no maggots were produced. Then, in another case, covering his jar with fine gauze, he showed that the flesh-flies came to lay their eggs in the meat, attracted by the odours of decay. Prevented in their attempt by the gauze, they laid their eggs thereon. The maggots in due time hatched on the gauze, whilst the decay of the meat proceeded below; and the question of the origin of the maggots was thus simply and for ever solved. The theory of the "spontaneous generation," in dead meat of living maggots at least, was thus finally abolished.

Now, on the simple basis of Redi's experiment, all future investigators moulded their plans and procedure. After Redi's time the microscope began to assume a place and power in scientific researches. Men began to discover a world in the water-drop, and an universe of life in the compass of a stagnant pool. Hence, whilst no one dreamt, a century after Redi, of alleging that insects and like animals were generated by the decay of animal matter, the question of the origin of animalcules and low life generally, was making its way to the front for decison on experimental grounds. In the middle of the eighteenth century, two observers, Buffon and Needham, began to investigate the manner of origin of animalcules. An infusion of hay, allowed to stand for a few days exposed to the air, swarms with microscopic animals and plants, of the larger among which it will take some three or four thousand, placed in a line, to make up the length of an inch. How come these living beings to swarm in the infusion of meat, hay, and dead leaves? Needham and Buffon boiled an infusion, thereby seeking to destroy any life it might originally have contained. Then corking up the infusion, they allowed it to cool. On examination, it was found to swarm with life. Having presumedly killed any life inherent in the infusion by the boiling, and having

secondly, prevented any access of life from without by securely corking the vessel, Needham and Buffon, as the result of many experiments, came to the conclusion that "spontaneous generation" was, after all, a fact. They believed the animalcules to have been generated from the decay of the infusion, and therefore without the existence of parent animalcules. Redi's victory seemed thus to be reversed. The verdict of 1668 appeared to be overthrown by the observations of 1748. "Spontaneous generation" seemed to claim the field to itself. But a new investigator was already in the field. Whilst Needham and Buffon were working at their experiments, another investigator was paving the way for a criticism in turn of their results. In this way, the Abbé Lazzaro Spallanzani appeared upon the scene.

II.

In tracing the growth of the germ theory along the line of the centuries, we have seen how Needham and Buffon, experimenting upon the development of animalcular life in closed flasks, found apparent reason for the belief that dead matter could give rise to living beings. They were, therefore, believers in the "spontaneous generation" (or *abiogenesis*, as it is nowadays called) of the lower animals and plants which they found in their infusions. An infusion was boiled, thereby, as they believed, destroying all germs of life. But, after cooling, animalcules, &c., did appear in the fluid. Hence, they argued that as the animalcules could not have gained admittance to the sealed flask from the outer air, they must have been generated, somehow or other, in the substance of the infusion of hay, meat, or other material. Living things were believed to be capable of springing into existence, without the existence of parent germs or of pre-existent life.

Spallanzani, however, came to the front in 1777, with evidence which overthrew the conclusions of Needham and

Buffon. He adopted a more careful method of experimentation, and showed that it was possible to so protect the flasks containing his infusions from all outward contamination, that they remained free from any development of life. Professor Tyndall has remarked that nowadays we see clearly enough that Spallanzani's experiments might have shown a development of life; for, repeated later on and elsewhere, these experiments yielded abundant life. Tyndall attributes Spallanzani's success to the purity of the atmosphere in which he worked; and Spallanzani himself gave forth to the world his idea of the cause of the freedom from life of his infusions. He assumed, and rightly, that he had been successful in keeping something out of his flasks. That something he further regarded as partaking of the nature of a "germ." In this fashion, and to this extent, Lazzaro Spallanzani may be credited with the invention of the "germ theory," of which so much is heard in these latter days.

Little advance was made after the days of Spallanzani, respecting the possibility of life arising without pre-existing life, until 1836. In comparatively modern times, in fact, the great battle of life from preceding life—the *omne vivum ex vivo* of the older schools—*versus* life from non-living matter, was destined to be fought over again, and with the aid of new and complex methods of research. In 1836, Schulze resolved to put to the test the idea that oxygen gas—the great supporter of animal life—was absent from Spallanzani's experiments. It had been urged that Spallanzani's flasks showed no life because they contained no oxygen. Schulze accordingly half filled a flask with distilled water, and added to the water animal and vegetable matter. The infusion was next boiled, by way of destroying any living particles it might contain. Then air, purified by being drawn through vitriol, was allowed to enter the flask. The vitriol did not alter the chemical composition of the air. The oxygen remained intact, but any *organic* matter—that is, *living* particles—were destroyed

by the vitriol. Hence only air, thus filtered, was allowed to gain access to the infusion. As a result, Schulze was able to show that in the presence of oxygen and of normal atmospheric air—rid of "germs"—an infusion capable of developing life would remain clear for three or four months, at least. We now know that as it was with Spallanzani, so it was with Schulze—the latter worked in a pure atmosphere, with relatively few germs. In a highly impregnated atmosphere, loaded with germs, he would undoubtedly have had life developed in his infusion. For Tyndall, repeating Schulze's experiment, showed that some germs will pass unscathed through vitriol, and that air passes in bubbles through the fluids, thus rendering the passage of the microscopic germs perfectly feasible. Tyndall tells us that if we cause the passage of the air to be slow and gradual, so that *all* its floating matter and germs will touch the vitriol or other liquid, the infusion may be preserved from contamination by germs; but he adds the interesting remark, that if we do observe this precaution, *water itself* will act as a screen quite as effectually as vitriol. The water merely interrupts the germs; it does not kill them, but acts as an air-filter.

In 1837 Schwann entered the field of controversy with the experiment of first placing meat in a flask filled one-third with water, and of then boiling the infusion, and allowing only calcined air to pass to it. Of course, this experiment was only a repetition in another form of that of Schulze; but Schwann's flask remained uninfected with life, clear and lifeless, for months, and the flesh therein did not putrefy. Schwann held that putrefaction was caused by the chemical action of the germs contained in a something which air itself held suspended within its limits. But in 1843 came a ray of light from the distinguished Helmholtz. He showed that if we separate a putrefying fluid from a clear and uninfected fluid by a thin membrane of some kind, the latter remains clear. The membrane allows the liquids to mix, but keeps back solid particles.

Hence it was argued that the solids arrested by the membrane were the cause of the contamination to which unprotected fluids were subjected. This line of inquiry was in due time popularized, so to speak, by Schroeder and Von Dusch between 1854 and 1859. These observers allowed air which had passed merely through *cotton wool* to gain access to their infusions. The wool was found to act perfectly as a filter in most cases. Fluids which putrefied when the air was admitted to them, kept sweet and pure when air gained access through the wool But milk remained obdurate, for it putrefied even after boiling and when supplied with filtered air.

Up to this time, 1859, the evidence was rapidly accumulating against "spontaneous generation." The "germ theory," holding that all life comes from pre-existent life, seemed to be victorious. But in 1859, Pouchet, of Rouen, published his book on *Heterogeny.* This was only another name for "spontaneous generation." In that volume Pouchet declared his belief that "spontaneous generation" was a fact of life and nature. By means of experiments conducted with apparent care and with exact method, he seemed to show that Schulze and Schwann had been in error in declaring that pre-existing life could alone develop life. Speaking of the germs which were supposed to exist in the air, Pouchet says if they were so numerous as they were alleged to be, "the air in which we live would have the density of iron," *apropos* of which remark Tyndall adds: "Had Pouchet known that 'the blue ethereal sky' is formed of suspended particles, through which the sun freely shines, he would hardly have ventured upon this line of argument." But three years after Pouchet's published attack, Pasteur, of Paris, published his paper on the living particles that people the atmosphere. A new figure had appeared on the scene, and one destined to effect marvellous results in the interesting drama, a new act of which he inaugurated in 1862.

III.

In our last paper, we had traced the growth of the "Germ Theory" to the year 1862, when Pasteur published his first paper on the living matter, or "germs," which the atmosphere contained. We also saw that in 1859 Pouchet, of Rouen, had published a strong defence of "spontaneous generation," and had thus asserted his belief in the production of living beings of low type from matter which, once alive, was now dead. We must not neglect, at this stage of our inquiries, to note that in 1836 Cagniard de la Tour made the discovery that "yeast" was in reality composed of myriads of microscopic plants, each measuring about the $\frac{1}{2000}$th part of an inch in length. Schwann, of Berlin, discovered the plant-nature of yeast nearly at the same time as De la Tour. The "yeast plants," when placed amid their proper soil, feed and multiply. Minute living beings, by their ordinary living acts, were thus seen to cause *fermentation.* The correspondence or analogy between this action and the production of diseases in human bodies, or the growth of animalcules in infusions, was very close, and evidently struck these observers. A pinch or drop of "yeast" added to a sugary solution, caused the solution to "ferment." The microscope showed that this "fermentation" was the result of the growth and indefinite multiplication of the yeast-plants. Why, then, it was asked, should not other living particles (or germs), sown within the human body, and breathed in from the outer air, possess the power of producing disease? the answer to this question was easy to supply on the lines of thought which the discovery of the yeast-plant had suggested; but the reply was not forthcoming until many years after 1836—not, indeed, until Pasteur came to the front as an investigator of the phenomena of infectious diseases in man and in lower forms of animal life.

Pasteur's work is of very wide and varied character, and

extends into well-nigh every department of medical science. In his paper of 1862, on the living bodies, or "corpuscles," which people the air, he showed that many of the floating air-particles, collected from the air of the Paris street, were the "germs" of living beings. Selecting these living germs from the dust specks, shreds of clothing, and mineral particles which formed the greater part of the air-motes, Pasteur sowed them in infusions of matter which were sterile and lifeless. From his sowings of the germs, he obtained the adult living beings, and in this fashion supplied the link which had been wanting in the connection of the living air germs with their actual source and origin. But Pasteur did more than this. He reviewed Pouchet's experiments. He repeated those of Schwann (mentioned in our last paper), which had been apparently refuted by Pouchet. He showed that Schwann's results were, after all, perfectly correct, and that Pouchet's criticism was, therefore, of none effect. A most interesting result—which Professor Tyndall has worked out with great skill—was likewise attained by Pasteur. He came to the conclusion that air was not uniformly of the same "quality," so to speak, in so far as its germs were concerned. That is to say, the air in some localities was proved to contain germs in greater quantity than was found in other localities. The atmosphere of some localities was, in fact, shown to possess no power of producing life in infusions. Thus, taking his stand on the great Swiss glacier or ice river known as the Mer de Glace, Pasteur—standing himself to leeward of the vessels—opened flasks which had been hermetically sealed, and which contained infusions capable of acting as a suitable soil for living germs to produce their adult forms of life. One only out of twenty flasks opened in the clear air of the glacier developed traces of life on after-examination. In the case of the other twenty flasks opened on the plains, amidst, presumably, an impure atmosphere, eight showed a plentiful crop of living beings.

To the Observatory caves of Paris, Pasteur took twenty-one

flasks, holding each a decoction of yeast which had been specially filtered, and which showed itself clear and uncontaminated. This decoction was boiled, by way of killing any life it might originally have contained, and the flasks were hermetically sealed by melting the glass in the blow-pipe as the steam escaped therefrom. All contact with the outer air was thus avoided. Ten of these twenty-one flasks were opened in the caves, and only one showed subsequent traces of life. The remaining eleven were opened in the courtyard of the Observatory. All of these latter flasks developed living beings with rapidity. The still, quiet air of the caves was thus practically incapable of developing life. The case of the one flask in which life tardily appeared, only serves to prove the existence of some solitary and special condition—due, possibly, to some accident in manipulation, and certainly not to any cause pointing to "spontaneous generation." The air of the courtyard, teeming with germs, developed life speedily; that of the caves, if it contained germs originally, had, through its stillness, allowed its particles to subside and to filter to the ground, leaving a pure, germless atmosphere above.

In 1861, Pasteur published a treatise on the fermentation of "butyric acid," and described the living particle which, in his opinion, produced the fermentative action. The French wine-traders, prior to 1862, had been much vexed by the changes which their wines were liable to undergo. Their exported wines often became acid and bitter, and hence their commerce was seriously affected. Pasteur, undertaking research into the causes of these commercial disasters, found that each special misfortune was due to a particular "ferment"—the "ferment," in other words, being *a living plant.* Experimenting on this subject, Pasteur was able to show that by heating the wine up to 50° Centigrade, the plants were killed, whilst the wines were uninjured. A simple discovery of this kind—founded, however, let us remark, on previous scientific labours of very exact and laborious kind—may be truly said to have saved the

wine commerce of France and other countries from serious, even irreparable, loss. Vinegar was also proved to be produced by a special kind of fungus. Just as the yeast plant converts grape-juice into alcohol, so alcohol in turn is converted by a fungus into vinegar. The study of failures in vinegar-making also led to important results. Vinegar itself goes bad when it is improperly exposed to the air. This result is due to the growth therein of lower plants. Hence Pasteur was able, through his observations, to show how the exclusion of the plant-enemies of vinegar preserved its health, just as it owed its very existence to plant growth of another and proper kind.

Pasteur's "Studies on Beer" have placed in the hands of brewers valuable and reliable means of similarly preserving that liquid from destructive change. These labours on the influence of lower plant life or the diseases of fluids, were carried out concurrently with researches on the nature of curious diseases to which the silkworms were liable. This research in turn led to the brilliant discoveries of Pasteur regarding the *splenic fever* of domestic animals, and the *fowl-cholera* of birds. But to these latter discoveries we must devote a special and illustrated chapter. Suffice it for the present to add that persons who may be given to undervalue the labours of science, viewed from a so-called "practical" standpoint, may find food for reflection in the idea that to Pasteur, France, and the world generally, owe their rescue from much loss and annoyance—not to say, in some cases, absolute ruin. Our gratitude to Pasteur, as a worker in the field of the "germ theory," must be mingled with sincere sympathy when, to quote Tyndall's words, we find that "Pasteur's devotion to this inquiry cost him dear. He restored to France her silk husbandry, rescued thousands of her population from ruin, set the looms of Italy also to work, but emerged from his labours with one of his sides permanently paralyzed."

IV.

We have now to pass to the consideration of the more recent discoveries of Pasteur in connection with the propagation of infectious diseases through the diffusion, planting, or sowing of the "germs" which are found in the blood of the infected subjects. An idea, in this way, may be witnessed in process of being traced out to its practical demonstration. The thought of Spallanzani and others, that infectious diseases are due to "germs," and that these germs are *living particles*, may be shown in the sequel developed into an actual fact of life.

We may find a convenient starting-point for our ramble, in the silkworm disease, which, through the work of Pasteur, was thoroughly investigated. The tracking out of the causes of a disease of the insect-world proved the preliminary to far more important researches on the affections of higher life. In 1865 the weight of the silk-cocoons produced in France was 8,000,000 lb. Large as this amount seems, we may be able to discover the enormous falling off which the 1865 crop exhibited, when we learn that in 1853 the weight of silk produced was 52,000,000 lb. In a single year—that of 1865—the fall produced a *loss* of 100 millions of francs. In 1853 the *revenue* was 130 millions of francs; and we also learn, that in the twenty years prior to 1853 the revenue from silk culture had doubled itself. The vast and overwhelming nature of the catastrophe, which thus threatened the commercial prosperity of France, can be fairly judged from the foregoing figures. During a period of fifteen years the silkworms (or caterpillars of the silk-moth), had died off by thousands, smitten by a disease which appeared mysterious alike in its origin and in its spread. No such calamity can befall any nation without attempts being made to stay the progress of the disease. As in the case of the existent vine-disease, remedies were proposed by the score. One author, writing in 1860, remarks that the *materia medica* of the silk-

worm "is now as complex as that of man. Gases, liquids, and solids have been laid under contribution. From chlorine to sulphurous acid, from nitric acid to rum, from sugar to sulphate of quinine all has been invoked on behalf of this unhappy insect."

To such a pass had matters come in 1863, that the Minister of Agriculture, as representing the French Government, signed an agreement, binding himself to pay 500,000 francs to the happy discoverer of a remedy which was said to be successful in arresting the disease. The remedy was tried, but without success. It was at this juncture, in June, 1865, that Pasteur appeared, prepared to undertake a thorough and scientific investigation into the mysterious plague which, so far, had ravaged the insect-tribe unchecked and at will.

Prior to the appearance of the dread disorder—which, by the way, was known as *pébrine*—it was noted that an affection named *muscardine* had attacked the silkworms. One Bassi had shown that the "muscardine" was undoubtedly caused by the growth within the silkworms, of a minute parasitic plant. In due time, these disease-plants gave origin to their microscopic "spores" or seeds. The spores, conveyed by the wind, carried the disease to regions in which it had been unknown. "Pébrine," however, was a far more fatal malady than "muscardine." The former caused black spots to appear on the bodies of the worms, and from this fact the name of the affection was derived. It affects the growth and nutrition of the little spinners of the silken thread, and finally causes their death. Doubtless, the prior discovery of the parasitic and plant-nature of "muscardine" assisted Pasteur somewhat in his search after the cause of the "pébrine;" and he was armed likewise with other items regarding the nature of this plague, which proved useful in guiding his footsteps towards its true seat and origin. So early as 1849, curious rounded bodies, showing apparently independent movements, were known to occur in the blood of the silkworms. These "corpuscles" multiplied in the insect's body,

and, undoubtedly, as was proved by Cornalia, cause the disease of the insect. Later on, these mysterious "corpuscles" were seen to inhabit even the eggs laid by the silkmoths, and from which new silkworms spring. The egg was thus apparently infected from the parent, and in turn, the infection, of course, grew with the silkworm, and thus became a hereditary complaint, propagated from parent to offspring.

A silkworm suffering from disease of this nature, seems to be affected in every part of its frame. The "corpuscles" literally reign over its body. When the diseased insect begins to "spin," its attempts are in vain ; for the silk-glands, instead of providing the fluid material, as in health, are filled with the corpuscles. Complete disorganization of the structure and life-functions of the unhappy insect prevails, and it ultimately dies, vanquished by the hidden enemies that have thus multiplied in its blood.

Pasteur, at the outset of his discoveries, drew attention to one very important point. The corpuscles, he saw, were small, and comparatively undeveloped in the egg. In the young worm even they might escape notice. But with the insect's growth its "unbidden guests" also increase in number and size ; while, lastly, in the chrysalis, and in the full-grown moth itself, the corpuscles are large and readily seen. Hence appeared clearly enough the reason why the old method of testing the eggs was fallacious and untrustworthy. The egg might apparently be healthy, and yet contain the germs of the disease fully represented in its constitution. But it is different with the moth. By passing the egg, the disease was liable also to be overlooked. By beginning with the diseased parents, or moths, in which the presence of the corpuscles could be fully traced, no difficulty could be experienced in pronouncing an opinion regarding the probability of the disease being reproduced.

Like all reformers, Pasteur experienced great difficulty in persuading the silk-growers to accept his *dicta*. They ignored the fact that a fine-looking cocoon might harbour a diseased moth. The egg, as we have seen, gave no hint or prophecy of what the

moth might become; and as often as not, the diseased eggs, chosen by the growers, produced bad moths. So convinced was Pasteur of the surety which lay in taking the moth as the fulcrum upon which to move the lever of thought and research, that in 1866, after inspecting fourteen parcels of eggs which had been selected for hatching, he wrote and deposited in a sealed packet his views of the probable results which would follow the development of the eggs. In 1867, the growers told their story. Pasteur's letter was then opened, and his prediction was so far verified that in twelve out of the fourteen cases the results agreed exactly with his views. He had said in his letter that many of the worms would perish completely, whilst others had well-nigh been extinguished by the disease, and the result was as he had predicted. Had the moths of 1866, from which the eggs had been taken, been inspected, as Pasteur advised, none of the fourteen packets of eggs would have been allowed to undergo development. Two packets of eggs he pronounced in 1866 to be sound, and born of healthy moths. These packets bore healthy caterpillars, and thus in a reverse way verified the correctness of his views.

The result of Pasteur's labours in connection with *pébrine* may be predicted from the foregoing account. By rearing healthy eggs, and by the destruction of all unhealthy and diseased moths and worms, Pasteur restored to France the well-nigh ruined industry of the silk-growers. He elaborated his methods to such an extent and perfection, that he was enabled almost to predict the exact extent to which the disease would prevail in a given case. He showed that infection was conveyed by the wounds which the worms inflicted on one another with their claws. He proved the infectious nature of the disease by infecting a mulberry leaf with the diseased matter, and by showing that the healthy worms which had fed but once thereon, in due time became diseased. He demonstrated that only by destruction and isolation of the affected worms could the disease be "stamped out," and a new and healthy breed

secured. In a word, Pasteur showed that *pébrine* was due to a plant-growth and propagation within the animal frame.

In our next paper, we arrive at Pasteur's discoveries regarding the *splenic* fever of animals.

V.

Dr. Carpenter, in a paper on "Disease Germs," speaks of Pasteur as "the greatest public benefactor of his time." The remark is highly *apropos*, and it is more than justified by the record of the services the eminent Frenchman has rendered to preventive medicine. We have seen Pasteur triumphant over the diseases of the silkworms. We are now to witness as important a victory in the domain of the diseases which affect higher life.

Splenic fever (or, as it also named, "anthrax," "carbuncle," "milebrand," and "pustule maligne") is a disease well known to veterinary surgeons, as a singularly fatal malady affecting horses, cattle, and sheep. Occasionally, splenic fever has been propagated to man, as, indeed, other ailments of lower animals are known to be capable of affecting the human being. Popularly described, this disease might well merit the name a "plague of boils;" for one of its main features seems to consist in the development of the symptoms of rapid blood poisoning, with swelling (or carbuncle), and general disintegration or breaking up of the bodily tissues. A bad case of splenic fever will kill an animal in less than twenty-four hours. In cases where recovery takes place, the healing is slow and prolonged—often unsatisfactory and incomplete at best. That this disease is of serious commercial importance may be gathered from the fact that between 1867 and 1870, no fewer than 56,000 deaths were reported amongst horses, cattle, and sheep in one Russian district—that of Novgorod. During the same period 528 human beings perished from splenic fever. In France the disease is but too well known. As *pébrine* deci-

mated the silkworm hosts, so splenic fever kills off cattle, sheep, and horses, and ruins many a once prosperous agriculturist. Dr. Carpenter tells us that between 1850 and 1860 a mild disease of this type was known in England, and he adds that he himself suffered from the "plague of boils," which was probably due to infection from an animal source. "Wool-

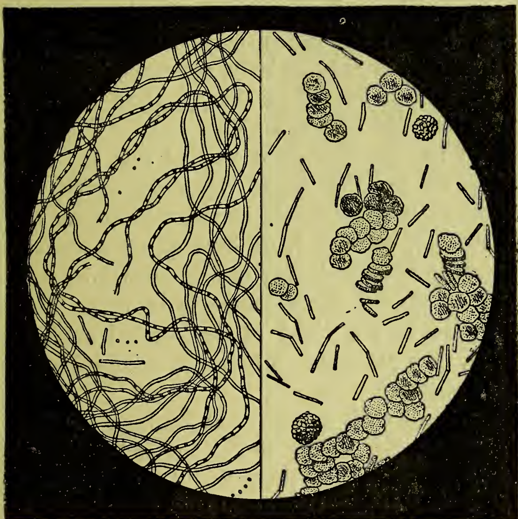

Fig. 1.—The *Bacillus* of Splenic Fever and its Development.

sorters' disease," an eminently fatal malady, known by occasional appearances at Bradford, is regarded as a species of splenic fever. The affection of the woolsorters appears to be caught from disease germs contained in the wool of infected animals.

Splenic fever is eminently infectious or contagious—which-

ever term we prefer. That it is communicated by the "contact" of healthy or susceptible animal bodies with diseased and living particles—with the nature of which we are perfectly familiar—does not admit of doubt. The history of splenic fever begins as far back as 1849. Pollender then showed that in the blood of infected animals a curious form of lower plant life was to be found. This living organism was named the *Bacillus anthracis*—that is, the *Bacillus* of anthrax, or splenic fever. In 1850, MM. Rayer and Davaine, in France, also described the bacilli, which may be described each as a minute, transparent rod-like body, measuring from the $\frac{1}{2500}$th part of an inch in length, to the $\frac{1}{1250}$th of an inch; and in diameter about the $\frac{1}{18000}$th of an inch. These bacilli are represented on the right-hand half of Fig. 1. There, highly magnified, we see the round blood-corpuscles, the bacilli, floating about, as minute rods in the interspaces. The bacilli may be straight, or curved, or bent at an acute angle; and, when carefully examined, they can frequently be shown to be composed of several short segments or rods. These bacilli literally swarm in the blood of the affected animals; whilst, after death, they are found in immense numbers in the various organs and tissues.

The manner of their development has been carefully studied by Koch, of Berlin, Cohn, of Breslau, and others. The importance of knowing how these bacilli develop and reproduce their life, cannot be over-estimated. Such knowledge of their nature is, in truth, the rational foundation of all successful investigation into the causes and prevention of splenic fever. For, that these bacilli are the cause of the malady, and that it is propagated through the sowing of the bacilli or their germs in healthy animals, are facts on which rests not even the shadow of a doubt.

In the blood of the infected animal the bacillus-rods may simply divide crosswise, so as to form new rods. The original rod in this case increases to "nearly double its length; then

the central protoplasm (or living matter) splits in the middle, leaving a clear space; finally, the outer sheath becomes constricted and divides; and this process is repeated in each segment." But the more natural, and, so far as the intensity and propagation of disease is concerned, the more important method of development is that whereby *spores* (corresponding in a manner to the seeds of ordinary plants) are produced by the adult bacilli or rods. These spores are extremely difficult of destruction. They retain their vitality for long periods, and when sown within the body of an animal reproduce the disease with rapidity and fatal power. When the bacilli are watched throughout their whole life history, by studying their development continuously, each rod is seen sooner or later to grow into filaments or threads of great relative length, when compared with their former size. These threads (which are duly figured, largely magnified, on the left-hand side of our illustration) may form loops, or spirals, or may even become matted together. The next stage consists in the formation within the threads, of bright or refractile points. Around these points, the living matter (or protoplasm) appears to concentrate itself. Soon, inside the threads, there may be seen oval bodies, lying in rows, and appearing distinctly enough under high microscopic powers (see Fig.). The oval bodies are the *spores*, destined to produce under appropriate conditions—namely, within the blood of animals—new swarms of *bacilli.* The rods next fall to pieces, and, as a result, the "spores" are set free, whilst occasionally, the spores, after being liberated, may remain for a time imbedded together in a jelly-like mass. But, whatever be the manner in which the spores are produced, the fact, terrible enough in its significance to animal life, remains—namely, that each spore, minute as it is, is laden with the potent poison. A drop of fluid containing a spore or two introduced into the blood of a healthy animal, begins the work of producing the rods. For the spores grow quickly into bacilli, like the parent-rods from which they sprang; and these latter will, in due course,

undergo the same development, liberating in time their countless generations of new spores.

The *conditions* under which the bacillus of splenic fever flourishes, feeds itself, grows, and reproduces its kind are—firstly, a nitrogenous fluid such as the blood. Koch, of Germany, and others have "cultivated" the bacillus in the "aqueous humour" of the ox's eye, in meat juice, and like fluids capable of supplying the bacilli with their accustomed food. Secondly, the bacilli (like lower plants) at large appear to demand and require a supply of oxygen gas. In this respect they resemble animals. They demand, thirdly, a proper temperature or heat. At a temperature of 60° Centigrade the bacilli, or rods, are killed; and when dry they can live for a few weeks at most. But their spores, or germs, possess a vitality far exceeding in tenacity that of their parent rods. For we know that the spores, when moist, are not killed by exposure to the great heat of 100° Centigrade; and that when dry they can bear with impunity an even higher temperature. The spores further retain their vitality for many years under ordinary changes of temperature and climate; and it is to these specks, and not the rods themselves, that we must look for the full knowledge of the effects and method of propagation of the disease they cause.

VI.

The proof that the *Bacillus* is the true and direct cause of the splenic fever of cattle may, therefore, be regarded as having been fully proved by Pasteur and others. It may be mentioned at this stage of our inquiries, that, along with Touissant, of Toulouse, Pasteur investigated the details of a singular affection which was found to cause the speedy death of fowls in France and Switzerland. This malady is called "fowl-cholera." It is eminently infectious, being propagated with rapidity and certainty from the affected to healthy birds. In our illustration

(Fig. 2), the microscopic appearances seen in the investigation of "fowl cholera" are shown. Here another species of *bacillus* is found to propagate itself within the blood of the infected birds, as the *bacillus* of splenic fever grows and multiplies within the ox and sheep. At a given stage, the bird succumbs to the virulence of the disorder; and if the bacilli (represented in the figure) be transferred to the blood of a healthy bird, the latter in its turn exhibits all the symptoms of the malady.

Facts like these invariably direct the minds of men towards a search for the remedy best calculated to avert the plagues which the humble "germs" can thus inflict upon the animal tribes. It is in the patient working out of the difficult problems such a topic presents to view, that we witness the untiring industry, zeal, and genius of Pasteur. It was shown that special localities became haunted from time to time by this plague. Such a fact impressed Pasteur that some defined cause, lying dormant for long periods, but now and then fanned by circumstances into activity, lay at the root of the new outbreaks. That cause, reasoning from the experimental side, could only be represented by bacilli or their germs. Deep in the soil of fields, the carcases or infected animals had been buried ten years prior to Pasteur's appearance on the scene of infection. Yet overhead, the disease was wont to appear, as if its very shadow hovered in the air. If the poison had been buried below with the infected carcases, might it not ascend to the upper soil and air? If so, what was the medium which bore it through the intervening soil? The answer was found in the *earth-worms;* for, collecting worms from the pasture-lands, Pasteur made an extract of the contents of their digestive systems. Inoculating rabbits and guinea-pigs with this extract, he found that severe splenic fever was developed in these animals. The source of the cattle-infection was thus made clear. The worms, laden with the bacilli derived from the buried animals, brought the infection to the light of day; and the cattle, feeding on the herbage, amidst which the worm-

dejections were cast, became thus infected from the carcases of their dead and buried predecessors.

So far the source of the mysterious outbreaks was made plain; just as it was found by Dr. Burdon Sanderson that brewers' grains, infected with bacilli, and used to feed cattle, had spread the disease far and wide at home. The next step consisted in the institution of an inquiry regarding the means of prevention or cure. The idea that the power and potency of animal poisons can be modified, forms the key-note of some of the most important researches which mankind has yet seen. As the apples we eat are the "modified" descendants of sour and small ancestors, so it was taken for granted that modification of bacilli, in another and opposite direction, was possible. The method employed was that of the gardener, namely, "cultivation." Thus, "bacilli or other germs were introduced into the blood of animals of different kinds from those liable to the original disease. From one animal to another, the products of this "sowing" of germs were conducted, and thus the "cultivation" proceeded. Again, the bacilli were "cultivated" in various fluids which were found to nourish them. Meat-juice, chicken-broth, the serum, or fluid part of the blood, the humour of the ox's eye, &c., were thus employed.

The results of such experiments are very astonishing. After two months' culture the bacilli seem to be as potent in their poisoning powers as when originally taken from the infected animal. Cultivated for three or four months, they apparently lose their original virulence; for animals inoculated with bacilli of this age, take only a mild form of the splenic fever, and usually recover therefrom. After eight months' culture, the disease produced by bacilli thus modified, is of the mildest type, and the animals are but little disturbed thereby.

As an offset to these results we find, however, that culture of another kind may restore or even exaggerate the poisonous powers of the bacilli. For, on inoculating with mild bacilli a new-born guinea-pig, Pasteur found that the animal died.

Its blood, being used to inoculate an older animal, and the process being repeated several times, a form of bacillus of the most virulent nature can be thus obtained. Cultivation of one kind modifies these "germs" in one direction—that of mildness; culture of another kind increases and intensifies all their fatal powers.

Fig. 2.—The Bacillus of Fowl-Cholera (magnified).

The practical outcome of these researches is not difficult to discover. If inoculation of the sheep or ox with mild and cultivated bacilli serves to protect it—after the subsequent mild attack of splenic fever—from all subsequent attacks, the protective value of such inoculation must, practically, eradicate the fatal tendency of the disease. Oxen, inoculated with bacilli cultivated from guinea-pigs, could not be infected with

splenic fever. Sheep and dogs, inoculated from bacilli cultivated in fluids as already described, were similarly protected. Chickens, inoculated with cultivated virus, were proved to be entirely free from any tendency to infection.

A convincing proof of the value of these discoveries was afforded in May, 1881. Of 50 sheep placed at his disposal, Pasteur "vaccinated" 25 with the mild virus on May 3, repeating the operation a fortnight later. All the sheep were slightly affected with fever, but completely recovered. On May 31, the entire 50 sheep were infected with strong and potent poison, obtained from a fever-stricken animal. Pasteur predicted that on the following day, the 25 sheep which had been vaccinated for the first time would be dead, whilst the 25 "protected" and previously inoculated animals, would be alive and well. Next day (June 1), the result was as follows:—By 2 p.m., 23 of the "unprotected" sheep were dead; and by four o'clock, the 2 survivors were also dead. The 25 which had been inoculated early in the month, on the other hand, were feeding undisturbed and well; only one, which had had a double dose of the poison on the previous day, having shown slight illness, which lasted for a few hours only. Thus into the hands of agriculturists, Pasteur has been enabled to place a remedy for splenic fever, as in the case of the silk-growers, he brought prosperity once more to their doors. Such services to humanity are beyond mere pecuniary reward. They constitute a life-work, which should receive ardent reverence and admiration, as the truest meed of praise we can bestow.

VII.

We have now arrived at that stage of our inquiries when it becomes necessary to review the position which the "Germ Theory" may be said to occupy in relation to modern thought. We have seen that, in so far as the evidence favouring that theory is concerned, no doubt seems to exist regarding the real and veritable nature of this explanation of the phenomena of

fermentation and allied action, as well as of the production of disease. How and why is it, for example, that certain infectious diseases (e.g., yellow fever) are confined to regions of a certain temperature? Why is it that diseases of this type exhibit a growth, development, maturity, decline, and death—showing thus their striking analogy with, and affinity to, the production and life of animals and plants? Why is it that each disease, as a rule, produces its like—that, when we sow small-pox we beget small-pox, or when we sow measles that disease appears? How is it that these and other diseases vary within certain limits, conforming, as a rule, to their type, but now and then exhibiting modifications and departures from that type? The replies to these questions can be satisfactorily answered in one way, and by one consideration alone. These diseases are the products of life and of living matter. Their "symptoms" are but another name for the varied features which their growth exhibits and produces within the confines of the human frame, and within the bodies of animals at large. Their propagation from one being to another means simply the diffusion of their "germs;" and the destruction of these germs, given off from the diseased surfaces, in each case, is a process synonymous with the killing of the special disease itself. Lastly, the bare fact that each disease affects special surroundings of its own; that typhus fever breeds within the foul air of rooms and houses; that typhoid fever and diphtheria grow amongst decomposing sewage in drains, attest the strength of the idea that, like animals and plants at large, the fever-poisons flourish only when they meet with their appropriate and natural soils. "Disinfection," in this light, means the bringing in contact with the fever-germs an atmosphere or soil in which they cannot exist, and which kills them as surely as an atmosphere of carbonic acid gas for example, is fatal to higher animal life.

Very important advances in our knowledge of the special living forms which thus breed diseases, have been made within

recent times. It has already been shown that splenic fever in cattle, &c., is due to the propagation of a microscopic form of plant-life—the *Bacillus anthracis*—within the bodies of our flocks and herds. "Fowl-cholera" is due, as has also been shown, to the growth within the bodies of birds of another *bacillus*-particle. It, therefore, becomes necessary that we should acquaint ourselves with the history, so far as that history is known, of these microscopic beings, whose power to affect the tribes of animal life appears so marked and decisive.

The name *Bacteria* has been very generally accepted as indicative of a primitive group of plants, belonging to the lowest class of plant-life, known botanically as that of the *Protophyta* ("first-plants"). Under this common name of "Bacteria" very different plants are included, but they all agree in wanting the well-known green colour (or chlorophyll) of higher plants, and in presenting us, each, with the appearance and characters of a single mass of living matter. This living matter is *protoplasm.* In one form or another we find this matter entering into the composition of animals and plants of every grade. It is the one substance—whether or not different "protoplasms" exist has not been proved—which exhibits life; and, as such, it fairly enough merits the title, "physical basis of life," which has been bestowed upon it. In the lowest animals and plants, each of which thus appears as a mere speck of protoplasm, we see this "matter of life" in its simplest guise. In the bodies of man and higher animals, and in the higher plants, "protoplasm" also discharges all the functions of life.

The lowest plants, many of which thus present us with lives the outcome of which is the production of diseases in higher beings, are apparently simple specks of living matter, possessing all the features commonly spoken of as belonging to the "cells" or minute bodies of which the tissues of animals and plants at large are built up.

The "Bacteria" of disease, however, differ in form and size.

For example, there is a curious little plant known as *Sarcina Ventriculi*, which grows in the stomach of man, and produces symptoms of serious nature. These plants consist each of small cells, which divide crosswise into four, and thus reproduce their like in simple fashion. Properly speaking, *Sarcina* is not included in the Bacteria family. Therein we find the *Bacillus*, and also a number of other beings, capable of producing, and associated with, infectious disease. Of Bacteria there are at least four kinds :—Firstly come the "round bacteria" (*Sphærobacteria*), consisting of small round cells. These grow on the surface of moist and decaying animals and plants. They often form jelly-like growths, which may be coloured blue, violet, or

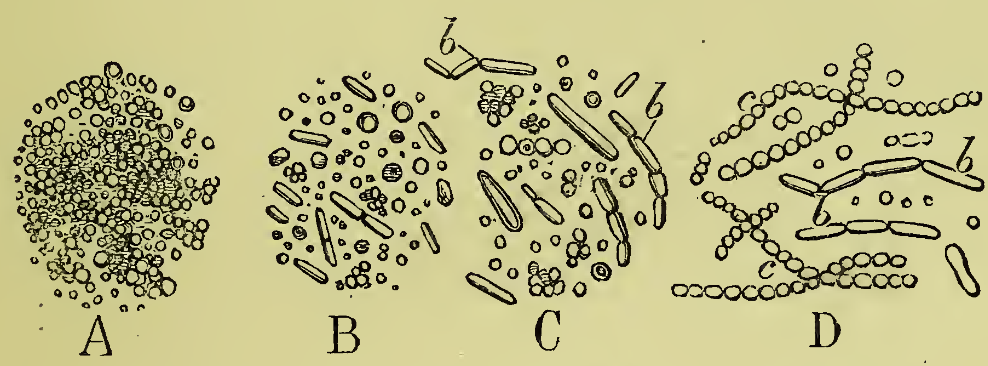

Fig. 3.—Development of Life in an infusion.

yellowish-green. Included in this tribe are found the little *Micrococci* (literally "small berries"), which we find present in cases of erysipelas, fowl-cholera, in hospital fever (or *pyœmia*), and in the eruptive fevers, such as scarlet fever, measles, &c. It is a micrococcus, probably, which causes the *pébrine* of the silk-moth, already described. The second family is that of the Bacteria themselves. Here we meet with little rod-like bodies, capable of swimming about in fluids. When organic fluids are exposed to the air, they putrefy by natural expectation. When we examine the progress of decay—which is thus really, however, a process of life-development—in any such fluid, as, for example, beef-tea or hay-infusion, we see that there is firstly formed on the surface thereof a thin scum,

or pellicle. Examined under the microscope (Fig. 3 A), this scum is seen to consist of microscopic particles, resembling the "round bacteria" just described. Later on (B) the fluid shows a development of true rod-shaped *bacteria*, which move about through the fluid, and which, according to some observers, originate from the round bodies (Fig. A) themselves.

The third class of these lowest plants includes the thread-like bacteria, or *Filobacteria* of botanists. Here the cells unite to form threads, which when straight are named *Bacilli*, or, when curved or bent, *Vibrios*. The latter forms are shown in Fig. C at *b*. When, on the other hand, a long string of bacilli are united together in chain-like fashion, what is known as a *Leptothrix* (Fig. D) is formed. It has already been shown how these bacilli propagate their like by means of the production of "spores," or germs, in their interior, which are in due time set free. Occasionally they may multiply by cross-division. These bacilli are the chief living elements we see associated with consumption, and allied forms of the disease known as *tuberculosis*. It is a bacillus which, as we have seen, causes splenic fever. Another bacillus has been found in typhoid fever, and these minute plants also figure prominently in malarious troubles, or those which (like ague) arise from contact with the exhalations of swamps and marshes.

A fourth family of these disease-germs includes those species which have been named *Spirobacteria*, from their spiral or twisted shape. These spiral forms are, as a rule, larger than the preceding species. In the mouth, teeth, and nose of healthy persons, these "spiral" plants are found. One species (*Spirochæta denticola*) thus inhabits the mouth and nose. But that the members of this family are not always of harmless type is proved by the fact that one form, *Spirochæta Obermayeri*, or "spirillum," as it is sometimes also named, is found in the blood of patients suffering from "relapsing fever."

THE CARE OF THE TEETH.

In his "Amatory Odes," Old Herrick is found to say:—

> "Some asked how pearls did grow, and where?
> Then spake I to my girl
> To part her lips, and show me there
> The quarrelets of pearl."

There can be little doubt that the admiration of Herrick for a good show of teeth is more than justifiable; and it is as easy to prove the opposite contention—namely, that teeth which, through ignorance or carelessness, have been allowed to become discoloured and decayed, disfigure even a handsome face, and mar the beauty of a smiling countenance. The possession of a sound set of teeth may be described as one of the best of our personal belongings, and as one which conduces in a very solid fashion to the preservation of health. Yet it is lamentable, at the same time, to discover how little care is bestowed upon these important organs. Young and old alike neglect them. The young are not taught, as they should be, to value their teeth as necessary agents in the work of digestion. The old grow careless as years roll on, and the teeth are left to take care of themselves, with the sure result of too early decay, the pangs of tooth-ache, aching gums, and disordered digestion.

It is easy to prove that bad teeth are a fertile cause of indigestion. To decayed and ineffective teeth may be ascribed the beginnings of very many of the most serious cases of indigestion which meet the eye of the physician. The connection between bad teeth and disordered digestion is easy to trace. Teeth which give us pain when we use them, predispose us to "bolt" our food. Two consequences result from this far too common practice. Firstly, we note that the stomach is loaded with food in an undivided state, and its work is thereby seriously augmented and unwarrantably increased. The food should be swallowed only after being well divided; and a plain method

of reasoning would convince us that, as a perfect set of organs for dividing the food exists (or should exist) in the mouth, nature evidently intends that they should be used, and used efficiently. Then, secondly, if we swallow our food without masticating it thoroughly, the starchy parts of the food are not duly changed into a chemical sugar (called "grape-sugar"), as nature intends they should be. The *saliva*, or "water" of the mouth, exerts such a chemical action on the food; and when the food is "bolted," it is evident that such starches as it contains must pass to the stomach in an unchanged condition, thus qualifying us for indigestion. For starch, it may be added, is a substance not digested in the stomach.

Clearly, then, good teeth are a plain necessity for health. Teeth consist of three substances—ivory (or "dentine"), enamel, and "cement." The enamel is the hardest substance in the body, and coats the crown of the tooth especially, as the wear and tear are greatest in that region. Yet this enamel is one of the first substances which goes to decay under the influence of the acids generated in the mouth when the teeth are neglected. Particles of food which remain in the mouth and lodge in the teeth undergo a process of fermentation, in the course of which acids that attack the teeth are produced. Decay of the teeth thus begins and continues, and deposits of "tartar" accumulate on the teeth. In time, the soft, delicate pulp found in the inside of the teeth becomes exposed. Its nerves, being irritated by the secretions of the mouth, give rise to the pains and pangs of tooth-ache, which, as often as not, is simply the penalty we pay for the neglect of the teeth.

The chief rules which must be attended to and observed in connection with the care of the teeth are as follows:—Firstly, if possible, the mouth should be rinsed out after every meal. Secondly, the teeth should be brushed, night and morning, with a *tooth-powder*—mere tooth-"washes" are ineffective in keeping the teeth clean and pure. A good powder, for example, is the "Precipitated Chalk" of druggists, well made and having a

little camphor added. This preparation is sold under the name of "Camphorated Chalk," and the camphor has a stimulating and healthy influence on the gums. Thirdly, use a medium tooth-brush, neither too hard nor too soft, and use water with the chill taken off, wherewith to brush the teeth.

By attention to these simple rules, not merely will a notable item in personal appearance be preserved, but health will be secured and pain avoided. Many a bad attack of toothache disappears when the teeth are duly attended to, and when some light aperient medicine has also been administered. If the gums are naturally irritable and tender, a few drops of tincture of myrrh in water should be used to rinse out the mouth, twice or thrice daily. If the teeth are naturally bad, and subject, through constitutional causes—inherited from parents—to decay, the dentist should at once be consulted. It is a moral duty to preserve health, and the best artificial substitutes should be employed when our natural teeth fail us. Lastly, smokers should pay strict and especial attention to the care of the teeth. All that has just been said concerning the teeth may be repeated, with increased effect, to those who indulge in pipe or cigar.

THE SKIN IN RELATION TO HEALTH.

Few people, save perhaps those who have studied physiology, entertain any adequate notion of the important part played by the skin in the maintenance of health. Besides serving as a covering to the body, and as a protection to the soft parts beneath, the skin has important functions as a regulator of the bodily heat, as an apparatus for getting rid of waste matters, and as a means of communication with the outer world. Let us briefly look at those duties of the skin which are concerned with heat and waste, by way of fitting ourselves for understand-

ing how the maintenance of a healthy body largely depends upon the perfect working of the skin. Firstly, then, the skin regulates the bodily heat. Every one knows that the under skin—situated below the outer skin or "scarf skin"—is well supplied with blood vessels. In shaving, a man draws a practical distinction between the two layers of the skin. So long as he confines himself to the upper or scarf skin he neither draws blood nor feels pain, for the outer layer has neither blood-vessels nor nerves. It is one of the few parts of the body which have no nerves or blood-vessels; but if the person who shaves, chances to infringe upon the deeper skin-layer, then pain is felt and blood is drawn. We can estimate how numerous must be the skin's blood-vessels, and how dense must be the network they form, when we reflect that we cannot prick any part of the skin-surface with the point of the finest needle without drawing blood. At all times there is passing through the skin a large quantity of blood. But we must not lose sight of the fact that the blood is a warm fluid, and that, therefore, the circulation through the skin, being one near the outer surface of the body, so to speak, brings the blood within reach of the outer temperature. There is thus a constant loss of heat from the skin. It is calculated that about 80 or 90 per cent. of the total heat-loss of the body, takes place from the skin. Now, under certain conditions, the quantity of blood in the skin is liable to variation. Roughly speaking, if, through any cause, heat is withdrawn from the body, then the quantity of blood in the skin becomes greater than before. If, on the contrary, less heat is given off through any circumstance of life, that circumstance will induce a greater flow of blood away from the skin, and towards the deeper parts of the body. The mechanism which rules the skin and its duties in relation to the quantity of blood which passes through its blood-vessels, need not be here detailed. Suffice it to say that, as a warm atmosphere acts on the nerves of the skin and causes relaxation and distension of the blood-vessels, with an increased flow of blood

to the surface of the body, so a chilled skin, causes the blood-vessels to contract, and to diminish in this way the blood supply. When a lady fans herself in a heated ball-room, she is producing the latter effect by means of the cold-air draughts she sets in action, and counteracts the effects of the former condition produced by the warm atmosphere of the apartment. The skin is, in fact, a "self-regulating" heating apparatus, controlled by nervous action, and serving, as we have seen, to give off a greater or less amount of heat as circumstances require.

The skin, however, is also a means for getting rid of waste matters. It is, in scientific language, an organ of *excretion*. Deep down in the skin-substance are numerous little *sweat-glands*. Each sweat-gland is a coiled up tube, the end of which ascends to the surface of the skin and opens in one of the well-known *pores*. These glands are imbedded in the layer of fat which lies below the true or underskin, and are surrounded by a network of blood-vessels. Sweat-glands are most numerous in the palms of the hands and the soles of the feet. One calculation gives between 3000 and 4000 to each square inch in the palm of the hand, those in the feet being equally numerous. The sweat-glands are least numerous in the back and neck. There they are said to number about 400 to the square inch. The total number of sweat-glands in the body is set down at about $2\frac{1}{2}$ millions. If the skin glands were uncoiled and their total length measured, it would be found that there exist about twenty-eight miles of sweat-tubing in the human body. There are other glands (which may be called *oil-glands*), in the skin, and these appear to throw out an oily matter which lubricates the skin, and which also nourishes the roots of the hairs.

That from our bodies the skin is constantly pouring out a large quantity of waste matter, is a fact which lies at the foundation of all health-knowledge concerning the skin and its structure. "Sweat" or "perspiration" is merely part of the

bodily waste that goes on incessantly. The skin, in fact, is one of a trio of organs devoted to getting rid of this waste. Its fellow-workers are the *lungs* and *kidneys.* All three organs perform much the same kind of work, and one organ can do a little of the other's work when the latter is temporarily weak from illness and disease. That is why, when the lungs are affected in any way, for example, doctors cause the skin and kidneys to act thoroughly through giving medicines that cause increased work of both organs. Sweat is a very complicated fluid. It consists chiefly of *water*, various complex *acids*, *minerals* (including *common salt*), *carbonic acid gas* (the same gas that makes our breath poisonous), and matters derived from the skin itself. We are always "perspiring," although many persons fail to realize that fact. The skin is always doing the work of a drainage system. The word "perspiring" has come to signify the obvious results of work and exertion, but these results represent merely the *increased* work of the skin. The hand and skin generally are naturally moist. The difference between the dry, unhealthy hand of a fever-patient, and the moist hand of health, is well known to all. Between 1½ and 2 lbs. (or pints) of *water* are given off from the skin daily, whilst about 400 grains weight of carbonic acid gas and 300 grains of solids (minerals, &c.) are also given off during each twenty-four hours of life.

The *health-aspects* in which the skin and its work may be regarded, are many and varied. We shall take up these aspects in due order. The first piece of advice which the knowledge of skin-functions presses home, is the necessity for strict personal cleanliness of the whole body surface. Naturally, we all recognize the force and morality of this piece of advice; but it is not followed in detail as it should be. If "dirt is only matter in the wrong place," it can nowhere be so much out of place as on the skin. But by cleansing the skin, we do not mean that this operation is simply directed to the removal of visible particles of matter. It must be borne in mind that the

skin is continually receiving from the blood the waste matter already mentioned. These matters are liable to remain on the skin surface. When not cleansed off that surface, they remain to form a layer of oily matter, within which the dust particles of the outer world become engrained, and plug up the pores, or openings, of the sweat-glands; thus preventing the healthy and natural action of these organs.

What interruption to the work of the skin means, can readily be imagined. If proof were wanting regarding the effect of a dirty, that is, an uncleansed skin—which, by-the-way, may apparently be a clean-looking skin—on health, we would find such proof in known facts relating to the artificial blocking up of the skin-pores. The body of a little child was varnished and covered with gold leaf, by way of representing the "Golden Age," in the triumphal procession which marked the accession of Leo X. to the Papal Chair. The child took part in the procession, but died in six hours from sheer skin suffocation—or, in other words, from the obstruction to the skin's work, represented by the coating of varnish and gold-leaf. The waste matters we give off perpetually, kill us by a sure form of poisoning if they are left in the blood. Persons who do not attend to the cleanliness and to the scrupulous purity of the skin, are, therefore, slowly but surely qualifying for ill-health through the interruption produced in the ordinary work of the sweat-glands. Primarily, then, we think that far greater attention should be paid to the skin and its welfare than is commonly bestowed upon this surface. Baths and bathing are not favoured, as they should be, by rich and poor alike. The masses do not know the necessity for *frequent warm baths* as the only true cleansers of the skin; and they have yet to learn the great truth that, in addition to *personal* ill-health, the owner of a neglected skin becomes a source of danger and annoyance to others.

A "dirty" skin, in physiological language, may be, to ordinary eyes, a clean-looking skin. For a skin to exist in such a state as to be capable of producing ill-health, it is not neces-

sary that it should appear dirty. The ordinary blackness or dirt we receive in the course of our labours, or through mere contact with the outer world, is readily seen, and it is usually got rid of because it is an eyesore. There are, however, more subtle forms of dirty skin which require the frequent application of the hot bath. If the skin is not frequently cleansed with warm water and soap, the sweat literally condenses on the skin-surface, clogs the pores of the skin, interferes with the healthy and natural action of the sweat-glands, and constitutes a source of disease, as well as of annoyance from the bad odour which the clothes of the person thus careless of his skin is sure to exhale. A "dirty" skin, then, may appear to the ordinary sight as a clean-looking skin, whilst in reality it is filthy in the extreme. The acids and fats of the sweat, together with the minerals exuded from the skin-glands, coat such a skin with an offensive, even if invisible, layer; and the under garments of such a person must naturally become impregnated with these secretions, even although they may be regularly changed and renewed. In proof of what has been adduced respecting the skin and its condition, the remark may be quoted that the skin of the poor, who, as a rule, rarely bathe or wash their body-surface, always seems to be clean. The word "clean," it is thus seen, may be used in two senses—popular and scientific. No skin can be truly "clean" which is not well washed, and that frequently. Hence the duty of keeping the skin thoroughly purified, is a personal duty of the very highest importance, in reference to the preservation of health.

We do not propose here to discuss the question of baths and bathing. A separate series of papers will do full justice to that very wide and important subject. All that need be urged at present is, that the frequent use of hot baths, with a good soap, is an absolute necessity for health preservation. The theory of soap, so to speak, is very simple. The oily matters of the skin will not give way before the use of water and friction alone. Soap is practically an *alkali*—such as soda or potash—combined

with oil or fat. Potash gives us the soft soaps and soda the hard soaps. When, therefore, we use soap, so much of the "free" or "uncombined" alkali—and in a good soap there should not be too much of this "free" material—unites with the oily matters of the skin, and renders these matters easily removed. Strong soaps, such as the potash soaps, injure the skin. They sweep away not only the oily deposits of the skin, but they remove the upper skin-cells, and thus leave the skin dry and hard. *Crude yellow, or "common soaps," should never be used at all for the skin.* The shining, aching, sore, and tight face of the schoolboy, "creeping unwillingly to school," shows that he has had perpetrated on his physiognomy a real enormity. There is a great deal of "free" alkali in common soaps and in many other soaps as well, which injures the skin, renders it liable to crack and "chap," and increases its liability to disease. Again, even the best and purest soaps may cause smarting to the skin of some persons, this arising from constitutional delicacy of skin; but in all cases the *soap should be thoroughly washed off the skin*, and by attention to this rule the smarting may often be avoided. Pears' Soap, and Field's Samphire Soap, are two of the best soaps made.

The common idea that the face should not be washed with soap is founded upon one of those curious prejudices, the origin of which would puzzle the most learned of antiquarians to discover. A good soap can never by any chance "destroy the complexion;" but the want of purity in the skin of the face is one of the first and most frequent causes of a "bad complexion." If the face "nips" after washing, we would say, Try a change of soap; or more primarily, be sure the soap is good, and then see that all the soap is washed off the face by the plentiful application of water. We ought to remember that in many cases it is not the soap that causes the skin to smart, but an unhealthy skin which resents an application that a healthy skin enjoys. *The water we use for washing the skin should not be hard.* This is a point, the neglect of which entails much misery on many persons in

the way of "chapping" and "cracking," especially after exposure to cold. The hard water decomposes the soap, through the union of the lime with the fatty acid of the soap, the result being that a lime-soap, which is quite insoluble, is formed. Soft water is always preferable where it can be had; but to the use of ordinary water, which is not too hard, there need be no objection.

There remains at present a point of much importance in connection with the care of the skin, to which special attention should be devoted. We need hardly say that there is no panacea for rendering the skin beautiful and healthy. No one medicine can change a bad or unhealthy skin into a healthy one. The sooner we learn the great truth that the skin is really a part of the body, and that it sympathizes strongly with ill-health in almost all its forms, the sooner will we discard all nostrums which profess of themselves to give health to the skin. We see the truth of these remarks in the course of many diseases. The skin peels off after many fevers, and even in a bad attack of biliousness or indigestion, the skin becomes dull-coloured and unhealthy. Again, there are many whose skin is naturally weak, tender, dull-coloured, or pale-coloured, and these are constitutional peculiarities, born with such persons, which do not admit of material change, though they may be bettered and improved, and often greatly modified, *by care and attention to the general health.* After all, we see that whatever tends to improve the general health, will tend to strengthen and improve the skin. Exercise, fresh air, good food, and, above all, *temperance*—these are the elements from which alone can be compounded the recipe for improving the complexion. A slight tonic will often cause the skin to assume a healthy look, when the system is low; just as after a holiday rest the dull skin of the formerly jaded and tired person acquires its healthy tone. No washes or lotions should be used for the skin; for it is, of course, to be assumed that those who use these "artificial aids to beauty" (?) are entirely ignorant of the barest elements

of health knowledge. There is no excuse for the use of any skin-lotion whatever. No such preparation can possibly do good to a healthy skin ; it will only intensify the diseases of an unhealthy skin; and, except for medical purposes, and under medical direction, the skin should never receive any application other than soap and water.

THE HAIR.

Hairs, nails, and teeth are commonly spoken of by scientific men as belonging to the system of *skin-structures.* They are formed by the skin-layers, and are, in fact, parts of the outer skeleton of animal bodies, just as bones form the inner skeleton. It appears curious, at first sight, to speak of teeth, for example, as belonging to the outer or skin-layers; for they are not only like bones in appearance, but are fastened into sockets in the jaws, and resemble bones in their hardness. The true test of the exact nature of organs and parts in animals and plants is the mode or manner of development. Not what things appear to be, but how they have grown, and what they have grown from, are the points to which the man of science pays especial attention. Now, judged by this common-sense rule, it is easy to show that teeth, hairs, and nails, are all closely related. They are one and all hard products of the skin, and, in turn, become connected, more or less remotely, with the scales of fishes and reptiles, the bony plates of the armadillo, and the feathers of birds. Indeed, a feather is, simply, a very complicated kind of hair; and there are certain birds, such as the emus and cassowaries, in which the feathers resemble hairs much more closely than do those of their more familiar neighbours.

If we inquire how feathers, hairs, and teeth grow, we shall

find a somewhat striking likeness between these structures in so far as their production is concerned. Each grows from a projection called a *papilla*, which evidently springs from the true or under skin in the case of the hair or feather. The papilla on which a tooth grows springs from the gum; but, as the gum is merely modified skin, specially adapted for lining the mouth, the tooth itself is seen to correspond exactly with that of a skin production. A nail is merely a plate of horny matter derived from the outer skin, and which grows from the true skin on a flattened projection called the *matrix*. Thus, broadly speaking, a hair, tooth, nail, and feather consist each of materials corresponding to the upper "scarf" skin (or *epidermis*), thrown off or produced upon projections of the under skin or *dermis* itself.

The hair-glands or projections are distributed very generally over the body, but are absent from the palms and soles. In the human body, the development of hair is modified, but occasionally—as in little "Krao," once exhibited at the Westminster Aquarium; in the Kostromas of Russia, father and son; and in other familiar cases—the growth of the hairs may come to resemble that seen in lower life. A hair itself, as we have seen, is merely a collection of outer or scarf skin "cells," welded together to form a filament or thread. It is usually oval in shape, and is covered by a series of fine scales which overlap like the slates on a house-roof. Below these cells is a layer of longer cells which form a kind of fibre making up the bulk of the hair. We frequently find that in the centre of the hair is a small space filled with the hair-marrow or *pith*. At its root, each hair is imbedded in a little bag, called its *follicle*. From the bottom of the bag rises the little projection, or *papilla*, in which the hair is produced. This projection, like that forming the nail and the tooth, is well supplied with nerves and blood-vessels. The hair-bag, or "follicle," descends into the skin, and often lies deeper than even the "sweat-glands" themselves. When a hair is pulled out, the inner layer of its

root-sheath which lines the bag also comes away as well. The root of the hair itself is hollowed out, so as to fit on the projection which, as we have seen, produces it. The over-lapping plates which cover the hair have their edges turned upwards. It would appear that, as the hair grows out from its bag, these plates scrape the sides of the tube, thus carrying out with the hair's growth, the oily matters and any other particles which have escaped into the bag. The "oil-glands" of the skin, as we saw when dealing with the skin itself, open into the bag, or sac, of the hair, and thus supply it with a natural pomade.

Hairs appear to run slantingly from the skin, and not, as is commonly supposed, in a perpendicular fashion. If we look at the crown of the head in young children, we may also note that the hairs grow in rounds or spirals, and it is this tendency of hair-growth which, even in later life, renders the orderly arrangement of the top-parting somewhat difficult of achievement. The hair, feather, and tooth agree in preserving, like the individual to whom they belong, a defined period of life. As the teeth drop out in old age, apparently by the natural failure of their nourishment and the absorption of their roots—a feature even better seen in the first, or milk, teeth—so the hairs die and fall away, to be succeeded in health by newer growths. And, as teeth decay and become diseased, so hairs are subject to diseases and affections of their own. Baldness is thus often due to some cause or other which has sapped the vitality of the hair-projections and abolished the power of producing new hairs. The *colour* of a hair resides in the pigment deposited in its outer-layer, and this pigment or colouring-matter has, apparently, two forms, fluid and solid. Light hair is said to possess fluid colouring-matter alone, the solid matter seen in addition, in dark hair, consisting of little grains of coloured substance.

A special feature of the hair is that popularly known as its "standing on end." Very minute muscles are found to be

connected with the hair-sacs. Acting under the influence of cold or mental excitement, these muscles cause the hair-sac to become more prominent, and thus give rise to the "goose-skin" aspect just alluded to.

The care of the hair is a feature of social life which demands special attention, and which, in the sense that the hair is in itself a natural ornament, is always certain to receive a very fair share of attention. There is no need—for the present, at least—to insist upon the folly of inattention to the hair; but there is a very distinct need for the correction of some popular notions regarding the treatment of the hair from a health point of view. For example, it is a common, but thoroughly erroneous, notion, that washing the hair frequently, is a common cause of permature greyness, of dryness, of falling out of the hair, and of consequent baldness. It should be very distinctly borne in mind, that all the evidence at hand really points the other way. If the hair is short, there can be no feasible objection—on any score of possible injury, at least—to a daily head-bath. Every one ought to wash the head at least once a week. Authorities tell us that this practice, properly carried out, actually keeps the hair from becoming prematurely grey. One thing appears tolerably certain—namely, that the great bulk of us do not wash the hair as frequently as we ought. The hair attracts a vast quantity of dust; and the dirty state of the scalp must certainly prevent that perfect nourishment of the hair-roots, described in our last paper, and which forms such a necessary part of the healthy nutrition of these appendages.

An author, Dr. Pincus, remarks ("The Hair and its Treatment."—London: Chatto and Windus) that "some people's heads perspire so little, their skin desquamates (or "scales of") so little, and they use so little oil or pomatum, that the daily combing of the hair suffices for cleaning, and no washes are required. If washing be necessary, but only required every month, soapy water may be used. On the other hand, the constant use of soapy water causes considerable irritation, and

a sensation of strain and dryness, often followed by increased formation of scurf." The best wash for the hair is *white of egg* (the yoke is not so effective or useful), which should be well beat up. The white of egg is preferable to the yolk in the eyes of some authorities, because it does not require so much water to free and cleanse the hair after its use. *Borax*, a very common hair-wash, certainly tends to render the hair brittle and dry. A good hair-wash, recommended by Pincus, is composed of a tablespoonful of *pâte d'amandes*, wheat, or rye bran, which is put into a saucepan of boiling water, and boiled from two to five minutes. This should then be strained through linen, and used luke-warm or cold, as preferred.

After washing the hair, it should be thoroughly dried, and as nature's own pomade (provided by the *oil glands* of the skin) has been washed off, a little oil or pomatum should be used to supply the place of the natural oil secretion. The oil penetrates best, just after washing and when the hair is quite dry.

Concerning the use of oils for the hair, there are many excellent and safe preparations at hand. Those who prefer a simple pomade—and, as a rule, the simple pomades are the safe ones—will find in the various preparations of *Vaseline* a capital medium for their purpose. A mixture of Vaseline and cold cream forms a very safe pomade; whilst the "Vaseline Pomade" itself, prepared by the Chesebrough Company, and sold by all druggists, may be recommended as an article of pure composition. "Vaseline" itself is a principle extracted from petroleum. Cocoa-nut oil is often also used in conjunction with Vaseline, and a drop or two of eau-de-Cologne or other scent may be added to the pomade. An important health caution in dealing with this topic is that of guarding against using *rancid* or *sour* pomades. Pomades containing much wax, fail in oiling the hair properly; other preparations containing vegetable oils are also recommended. Messrs. Rowlands' preparations for the hair may also be mentioned as reliable and safe articles, which have stood the test of a very long period of

public trial. There is one affection of the hair for which a plentiful use of oil is recommended, and that is the "splitting" of the hairs. Dr. Pincus, before quoted, strongly insists upon this latter remedy.

The *use of the hair-brush and comb* is in itself a topic of high importance. A prevalent idea is that which asserts that frequent brushing and stimulation of the scalp with a hard brush is the proper treatment of the hair. Nothing is more contrary to scientific experience and fact. All authorities on the treatment of the skin and hair agree in saying that the use of a hard brush, as too commonly used, is destructive to the hairs. The skin is irritated by hard brushing. The hairs are broken and bruised by such treatment, and the idea that scurf is removed by this practice is delusive, for scurf forms faster than before. *The hair-brush, therefore, should be soft.* Dr. Pincus says, "to work away at the head, to smooth naturally curly hair, or, as is sometimes intended, to curl smooth hair, or to remove all the scurf from the head," is "very pernicious." The ordinary hair-brush, of soft texture, is as good a brush as one need use. The bristles should not be set too closely, or be too stiff in texture. The *wire brushes*, now common, are also useful. Their excellence is derived from the same conditions which make an ordinary soft, pliant hair-brush pleasant to use.

The style and influence of *hair-dressing* is a topic of importance to the fair sex. Every health-reformer is bound to express his or her gratification that the days of the chignon and of hair-pads are past and gone. The present or Grecian style of dressing the hair, in which pads are dispensed with, and the hair is gathered into a simple coil behind, is undoubtedly a return to a classic and healthy fashion. There may be objections on the score of taste—itself a variable condition—to the "boy's" or short-cropped hair as a feminine style; but where health-considerations intervene, there need be no objection to the adoption of this latter mode, especially for girls. Many diseases and weaknesses of hair are clearly traceable to

the reign of the chignon. For once in its existence, "fashion," the much-abused, has led directly to a much-needed reform in the matter of feminine hair-dressing. It is only to be regretted that what is rational in the modern hair-dress does not extend to the chest and to the feet. But our fair readers should be told that singeing the hair is not of the slightest use as a measure for hair stimulation, and the frequent use of the "curling-tongs" cannot but be detrimental to the health of the head-covering.

THE CARE OF THE HAIR.

Pincus tells us that the life of a hair varies from two to six years, and that it grows most rapidly at its birth, growing at only half its early rate when it has reached its middle period of life. This author also gives the following interesting recital with reference to cutting the hair. He alludes to the belief that frequent cutting increases the length of the hair, and adds, "Cutting has a different effect from that generally supposed." On the heads of healthy men Pincus "cut off circles of hair about an inch in diameter, and from week to week compared the intensity of growth of the shorn place with the rest of the hair. The result was surprising. In some cases the numbers were equal; but generally the growth became slower after cutting; and I have never observed an increase of rapidity." If the correctness of these views be admitted, they should certainly alter common notions respecting the value of a "good crop."

Pincus also makes some interesting remarks concerning the "normal loss of hair." He has attempted to estimate the normal number of hairs shed daily in health at different ages, and he arrives at the following conclusions in this matter:—In the finest growths of hair there are to be found hairs of

different lengths; and this exists as a matter of normal growth. It would thus seem as though each individual hair had a life and growth (or length) of its own. A considerable number of hairs fall out whose length is less than that of the typical hair, and these hairs mostly come from the middle of the head. In the daily loss of hairs in women, not more than a quarter of the hairs shed should measure less than six inches. Amongst the hairs that drop from men's heads are "point hairs," showing no trace of the scissors; hence it is important to distinguish the "point hairs" from pieces which are merely torn off. Where these "point" or normal and uncut hairs are shed in large proportion (i.e., when compared with the cut or broken hairs), there is every reason to suspect disease of the hair.

Health reformers who run a tilt against pads and chignons in the fair sex in the matter of "hair health," are bound to retort upon the sterner sex on account of that nineteenth century monstrosity, the tall hat. It appears to be a matter regarding which there exists no doubt—amongst specialists, at least—that the wearing of the ordinary hat, close-fitting and ill-ventilated, is a frequent source of early baldness. A tight-fitting hat must, at least, through its pressure on the blood-vessels of the scalp, cause the nourishment of the hair to be interfered with. Hats should be made of soft materials, close-fitting if need be, but without pressing unduly on the head; and they should further be ventilated, as many hats are, by punching a few holes in the crown. There is, in truth, no reason why our heads should not have the benefit of full and free ventilation.

It has often been recommended as valuable, from a health point of view, to have a space left between the lining band and the hat itself, and it has also been suggested that air-holes, deftly concealed, might be made in front and behind as well. Such a plan would at least, we believe, lessen the tendency to chills and head-colds, and would unquestionably be beneficial for the hair and its growth. The need for hat-reform, however,

on the score of comfort, seems to be very great. In this land of storms and high winds, the "dress hat" is the most awkward of head-gear. It is the head-gear most readily soiled and spoiled by the weather, and it is, as often as not, a heavy burden to the wearer. Reform in hats seems demanded alike by common sense and by health reform. Let us hope that in this respect the conservatism of fashion will not in time prove too strong for the efforts of reform.

It is a noteworthy fact that free exposure of the hair to the atmosphere is not inconsistent with, but, on the contrary, often favours, a rich development of hair. Bluecoat boys, so far as we are aware, do not suffer from thinness of hair. Those nations which leave the head largely or constantly uncovered rarely suffer from baldness. Doubtless, there may be elements in the constitution and life of the peasant or savage, favouring healthy hair over those conditions which destroy the hair of civilized races. But it appears pretty certain that a good head of hair can never be expected where it is "cabined, cribbed, and confined" in any way. One fact which seems powerfully to argue in favour of the advantage of uncovering the head, in so far as healthy hair is concerned, is found in the observation that women, who have the head less frequently and less tightly covered than men, are rarely bald, save from some actual hair-disease.

Dr. Pincus, from whom we have already quoted, strongly advises ladies to undo their hair at night, to unplait the hair, and to wear it loosely in a net. In this way the nourishment of the hair is duly provided for. Concerning night-caps, these, Pincus adds, should always be light. By a providential kind of correlation, it might be added, that those who require warm head-gear at night are usually of an age when the condition of the hair is not likely to prove a source of any anxiety or discomfort. Those who are forced to remain in bed for long periods, through illness, should have the hair oiled and combed with a coarse comb daily. The head may, if circumstances

permit, be washed twice a week with soap and water, and the water may be warm, lukewarm, or cold, as taste directs, or as the health may permit. In cases of long-continued illness, it is often advisable to cut the hair, not short, but so as merely to reduce its length by about a third. This practice will be found useful, not merely from considerations connected with the cleanliness of the hair, and with greater ease in maintaining its natural state, but also from a regard to the stronger after-growth which may be encouraged by the general diminution in length.

We have already spoken of peculiar developments of the hair in the human race, and to the cases already named—those of " Krao " and the " Kostromas "—we may add that of Julia Pastrana, who was exhibited in London, and who, in addition to a very highly developed body-covering of hair, possessed a beard. Her little son was similarly coated with a hairy covering. Mr. Darwin has put on record several interesting cases concerning the influence of heredity or inheritance in producing peculiar traits of hair. Doubtless, baldness and paucity of hair is often an inherited state. " I knew," says Mr. Darwin, " an Irish gentleman who, on the right side of his head, had a small white lock in the midst of his dark hair; he assured me that his grandmother had a similar lock on the same side, and his mother on the opposite side." This and other cases of similar nature tend to impress upon us the truth that even the hair does not escape those laws of variation and inheritance which so powerfully affect the bodies of animals and plants, and the world of life at large.

THE LORE OF THE HAIR.

There is no part of our bodily belongings which presents a more fertile field for the research of the curious than the social history, or what might be termed the "folk-lore," of the hair. For example, the traffic in hair is immense, and the skin product represents, commercially, a very large sum of money, in respect of the annual transactions which take place over its worth. The buyers of hair have their stated markets, just as the dealers in any other commodity repair to their accustomed marts. The peasant maidens of the Lower Pyrenees and of Brittany, as well as of other provinces, travel every year to the fairs at which the hair buyers are in attendance. The quality of the hair as it grows on the head is duly estimated, its length is valued, the bargain is struck, and the locks and tresses speedily fall a prey to the scissors, whilst the young ladies retire often with a considerable *quid pro quo*, in the shape of money. It has been estimated that in Paris and London alone, more than one hundred thousand pounds' weight of human hair is used every year in the manufacture of the "false hair," pads, wigs, and other appliances, whereby art aids to conceal what are often erroneously named the "defects" of nature. If, as has been calculated, an ordinary individual will furnish to the hair market about $\frac{3}{4}$ lb. weight of hair, it may be shown that the number of persons who sacrifice their capillary stock to the scissors of the dealer must be immense.

What is known in the trade as "Church hair" comes from convents. It is of fine quality, and commands high prices in Italy, Spain, and France. Different countries show their race-differences, in the preponderating colour and hue of the hair they send into market. The "golden hair" is usually a German product; "yellow hair" comes from Holland; and "black hair" from Spain, Italy, and France. In Britain, the

red hair indicates the Danish element, seen specially in the North, and the black shows Celtic descent; the brown being possibly the Saxon hue. The prices paid for hair vary greatly with quality, length, and with colour especially. Fashion reigns supreme over the hair-market. If a craze for golden hair sets in, that particular shade will rise in value, just as when red hair becomes the prevailing and desirable tint, the latter hue will command the market. Golden hair, in the flush of the fashionable tide—indeed, this hue is always sought after—fetches from 8*s.* to 10*s.* per ounce. White hair is in demand more or less constantly, from the patent fact that the natural hue of the hair in age will require frequent imitation in the form of wigs, &c., and this colour has been know to sell for 1*l.* per ounce. Some heads of hair are comparatively valueless for what is named "high-class work," whilst others, at the opposite market extreme, will fetch far more than their weight in gold. From a French cranium, it is estimated about 5 ozs. of black hair are obtained on an average; Italian heads yield about 6 ozs.; and the Germans about 10 ozs.

The hair-dealer, like the tea-taster and the wine-taster, acquires by long practice an educated touch, as well as a keen technical sense of hair-nature and value. Touch and smell appear to be mostly relied on by hair-dealers as means of detecting the value of their commodity. It is a well-known fact that certain nations possess each a special odour of hair and skin, which is recognizable amongst all other odours by persons who have been associated with the individuals in question. The negro race is known to possess a very characteristic odour, which, as the story goes, a venerable sea-captain can recognize miles off when a slave-ship has crossed the wind. The Chinese hair is said to have a musky smell. Fraudulent treatment of the hair is, of course, a feature against which the hair-dealer has especially to guard; but "practice makes perfection" in this as in most other trades and employments, and the practised dealer is able to tell by the smell and feel whether or

not the hair has been tampered with. Some dealers claim to be able to tell whether or not the hair has been taken from the living or from the dead, but this latter statement is one which certainly requires confirmation.

The chemical lore of the hair reveals many curious facts. Hair varies in its chemical composition; not certainly in the elements of which it consists, but in the relative proportions of these elements. Carbon, hydrogen, oxygen, nitrogen, and sulphur are found in the hair. Black hair is said to give much oxygen, but little carbon or hydrogen, on analysis. White hair contains sulphate of alumina and phosphate of magnesia, whilst in the white hair of old age phosphate of lime (the chief mineral found in bone) occurs in addition. Red hair contains iron, a large quantity of sulphur, and a coloured oil. Fair hair at large, affords most sulphur and oxygen on analysis. The particular substance which is found in hair is *Keratin*, a material allied to horn in its nature. It is this substance which "smells" so powerfully when hair is burnt or when horn is singed.

The *strength* of hair, when scientifically tested, reveals some interesting facts. A single healthy hair supports a weight of about four ounces; but the power varies greatly with the texture, size, age, &c., of the hair. The old proverb that "union is strength" receives from the combined strength of the hairs a new illustration. One author calculates that the weight of an audience of 200 people might be supported by the hair of a single head in the audience, and have a certain amount of strength to spare. The combined strength of the hairs of say 130,000 people represents a breaking strain of two millions of tons.

The varied colours of hair appear to be referable to three chief pigments; yellow, red, and black. It is by the combinations of these colours that all the shades of hair are produced. Black hair has yellow and red as its basis, and it has been shown that

the hair of the negro contains as large an amount of red colouring-matter as does red hair.

An author makes a singular and most interesting reference to the advantages—matrimonially speaking—of particular shades of hair. It is found that the spinsters are mostly light-haired; whence it is inferred that dark-haired ladies have better matrimonial chances than their light-haired sisters. Statistics, we are told, show that for every two dark-haired women who are unmarried, there are three fair-haired ones. Our author wisely, perhaps, admits his inability to give a reason why the sterner sex should "flirt" with the blondes and "marry" the brunettes. But Dr. Beddoe, an authority on social statistics, maintains that this "conjugal selection" is a reality; whilst even Mrs. Somerville remarks the facts just alluded to. Be this as it may, the suggestion which follows is, of course, highly interesting. Since, if it be true, that the light-haired ladies are left to the consolation of spinsterhood, the "fittest" will survive, according to the law of life, and their darker sisters will come to the front in the "struggle for existence." We have, however, by no means exhausted the curious lore of the hair.

THE HAIR AND ITS TREATMENT.

THE *number* of hairs which exist in each square inch of head-surface, varies, of course, with the nature and quality of the hair itself. It would appear that the number of the hairs bears a special relation to their colour. Coarser and darker coloured hair grows thinner than the light-coloured varieties. Estimates have been formed of the number of hairs per square inch which the head bears. In black hair, nearly 600 hairs exist to the square inch; flaxen hair is said to number nearly 750; and chestnut hair about 850. Calculating the average-sized scalp

to contain 120 square inches, a person with black hair may thus be supposed to possess about 72,000 hairs in his head. The chestnut-haired person, on the same estimate, would possess 78,000, and the flaxen-haired about 88,000 hairs.

The *length* of hair varies greatly. The reason why the hair of the gentler sex is longer than that of the male cranium appears to consist in certain constitutional peculiarities connected with the nature of the hair-glands and with the hair itself. Possibly, also, the head is less frequently covered in women than in men, and this undoubtedly tends to freer growth. Certain nations possess a special development of hair. Amongst the Malays hair seven feet long can be seen. An American lady's hair measured fifty-eight inches in length; whilst cases in which women's hair has measured nearly six feet are by no means uncommon. In 1786 a woman was accustomed to exhibit the strength of her hair in London by encircling a large weight of 200 lbs. with her locks, and thus raising the weight from the ground.

One of the most singular features of hair-growth and history is that connected with the sudden blanching of the hair. When age advances, or even after illness, it is not surprising to find the hair exhibiting greyness or whiteness. But when, in a single night, or even in a few days, the hair becomes blanched, the phenomenon is naturally held to be both curious and interesting. It is said that the hair of Marie Antoinette became grey in a single night, in 1791, after her arrest. In a few days, that of Mary Queen of Scots is said to have changed from auburn to grey. Byron's well-known lines,

> "My hair is grey, but not with years;
> Nor grew it white
> In a single night,
> As men's have grown from sudden fears,"

only illustrate a well-known fact of physiology. A Sepoy, captured in 1858 after the Indian Mutiny, was undergoing

examination, when his hair, which was jet black, was seen to alter its colour, and become grey in half-an-hour. A lady, aged thirty, being once called upon to give evidence in a court of law, was alarmed and annoyed by the summons, with the result that her hair became grey in a single night. There would thus appear to be no reason to doubt that under the influence of strong mental stimulation the colour of the hair may be markedly and quickly changed. The occurrence, so far from being regarded as of abnormal kind, only serves as a fresh illustration of that wonderful influence of mind over body which forms at once one of the most interesting, as well as the most intricate, topics with which the man of science has to deal.

The *general care* of the hair has already been alluded to in the course of these articles. In addition to what has there been said regarding the use of a soft brush, we may add the important caution that the use of a small-tooth comb is decidedly injurious to the hair. A fine comb, used on children's heads especially, and on the adult's head as well, is certain to increase dandriff or scurf. The comb in this case actually causes and increases the affection it is believed to cure.

Concerning *the treatment of common affections* of the hair, an important remark is that which impresses upon us that the hair in respect of its ailments is really an intimate part of the body, and, as such, owes many of its diseases to conditions which are only to be improved or banished when the body, as a whole, is made to enjoy better health. To suppose, for example, that greyness, falling hairs, and premature baldness, are each and all to be cured merely by local applications to the head is to commit the error of supposing that the hair and its growth are independent of the bodily mechanism and functions. So far is this from the case, that the best authorities are given to look upon such hair-ailments as mere *symptoms* of the bodily state, and not as constituting by and of themselves special diseases. A first point, then, to which all who suffer from falling hairs, and premature greyness should pay special atten-

tion, is that which enforces upon us *the duty of carefully investigating the state of the general health.* It is a well-known fact that in certain diseases, the falling off of the hair is a natural and expected symptom; but when the disease itself is cured, the hair regains its natural state. Many a case of baldness has been prevented by timely attention to the general health, and by a course of tonics, a change of scene, and like restorative measures, when lotions, liniments, &c., had been tried in vain. Again, we should bear in mind that the hair, like all other parts of our frames, dates its nature and health very largely from a *hereditary* point of view. That is to say, just as certain persons may be born with strong heads of hair, inherited from their parents, so others are born with weak hair, and exhibit defective processes of hair-growth. So that in dealing with the hair, we must take into account all the circumstances of constitution which require to be attended to in affections of other parts of our frames.

The main details to be borne in mind in dealing with the treatment of weak hair—where no actual disease exists—may be thus summed up. Firstly, the frequent use of the brush, which must be soft. It has been well said we cannot brush the scalp *too much* or the hair itself *too little.* Stimulation of the scalp-circulation is thus effected, and the blood-supply of the hair favourably influenced. There is no virtue claimed for so-called "electric" brushes which cannot be as perfectly obtained by using an ordinary hair brush. Secondly, the hair should not be crimped, curled, or twisted tightly to the head. By such treatment the roots are injured; and the use of the curling tongs has already been condemned as injurious. Thirdly, the use of all "hair dyes" is pernicious—and of the "safest" of these preparations this remark holds good. A special article will deal with "dyes" and their effects. Lastly, when the hair demands a tonic application, the following—which any chemist will compound—may be tried:—Tincture of red cinchona bark, one ounce; tincture of nux vomica, two drachms; tincture of cantharides, half a drachm; add eau-de-Cologne and

cocoa-nut oil to make up a four-ounce mixture. Apply to the roots of the hairs with a soft sponge night and morning.

Premature greyness of the hair is well known to follow many diseases, and especially those of a mental kind. There is the strongest possible analogy between the sudden greyness of the hair appearing as the result of strong emotion, and that more gradual greyness which we see following mental trouble and nervous diseases. Extreme application to study has been followed by the development of greyness, which disappeared on the student taking rest and acquiring a more robust state of health. Captain Markham noticed that the hair on the faces of those of his crew who were long absent from their ship in the cold of the Arctic Circle became grey, or even white. The natural hue of the hair returned in three or four weeks. It is highly probable that the intense cold in such a case possessed a distinct effect on the nourishment of the hair, through its action on the skin-circulation. We certainly know that hair grows faster in warm than in cold weather; and that extreme cold should check the growth and alter the natural hue of the hair is, therefore, by no means an unnatural or unusual occurrence. Physicians note that after severe attacks of neuralgia the hair of the scalp nearest the affected region exhibits greyness, which disappears on the cause being removed. Sir James Paget speaks of one case in which a patient, the subject of severe nervous headaches, was accustomed, on the day succeeding the attack, to find patches of greyness in the hair; the normal colour being, however, restored in a few days.

Cases of greyness of a premature kind will usually be found to depend upon some disorganization of the system which medical care and attention to the general health will cure. It is to be borne in mind that, just as bad teeth may be hereditary gifts, so premature greyness and baldness also "run in the blood," to use the familiar phrase. In such cases it may be impossible to counteract this tendency. But where the means are being taken to restore the health in cases of sudden or premature

greyness of hair, Dr. Leonard recommends the following application:—Cocoa-nut oil, 2 ounces; tincture of nux vomica, 3 drachms; bay rhum, 1 ounce; and oil of bergamot, 20 drops. Washing with yolk of egg is also highly commended in such cases.

Of the hair-troubles, which cause concern to civilized people, baldness—or *alopecia*, as it is technically named—is perhaps the most common. The occurrence of baldness has been noticed by very ancient writers, and has been almost invariably regarded as a sign of physical weakness, if not of actual disease. Baldness and leprosy were thus associated together; and as early as 456 B.C., the Greek writers speak of this affection. Amongst the curiosities of the hair must be ranked bald or hairless individuals, who present contrasts to the hairy races already alluded to. As a rule, ordinary baldness is much more commonly seen in the light-haired, than in those who possess dark hair. The hair begins to come out readily on being combed or brushed. In the male sex, the cause is either bad health, nervous worry, or actual disease; whilst in women, the falling out of the hair may be due to the above causes, or, in addition, to abuses in dressing it; and to such malpractices, curling and crimping it tightly, the injurious effect of curling-irons, and the use of hair-dyes, are the most common.

The *treatment* of ordinary baldness is divided into constitutional or general treatment, and specific or local remedies. The first is a matter for the medical man, whose efforts to counteract tendency to disease may be sufficient to arrest the baldness. Supposing that there is persistent daily loss of hair, the following remedy, recommended by Pincus, may be tried:—Fifteen grains of bicarbonate of soda should be dissolved in an ounce of water, and a little of this solution is to be well rubbed into the scalp daily. This treatment, Pincus recommends, should be persisted in day by day, as excellent results follow its continued application. Sir Erasmus Wilson says that a lotion composed of one ounce each of spirits of hartshorn, chloroform,

and sweet almond oil, added to five ounces of spirits of rosemary, and well rubbed into the roots of the hair after brushing is effective. If this lotion should prove too strong, it may be used half-strength, being diluted in the latter case with eau-de-Cologne. Of other lotions, which are to be recommended in cases of baldness and hair-falling, the following are examples:—(1) Tincture of Spanish flies, two drachms; tincture of nux vomica, half an ounce; tincture of capsicum, one drachm; castor oil, one and a half ounces; eau-de-Cologne, two ounces. Apply night and morning with a sponge to the roots of the hair after brushing. (2) Spirit mindererus, two ounces; carbonate of ammonia, half-a-drachm; glycerine, half-an-ounce; castor oil, half-an-ounce; bay rhum, five ounces. Directions as in preceding case.

The foregoing remedies will be found serviceable in the treatment of commencing general baldness, where the whole of the scalp appears to be parting with its hairs. The bicarbonate of soda solution, as recommended by Pincus, may possess a slight tendency to lighten the colour of the hair. But if the hair is carefully dried, after using this lotion, the colour will not alter materially; and any change of hue which actually occurs will certainly be inconsiderable in extent, and will rapidly disappear. *Electricity* has been recommended by some authorities as a remedy for general baldness, one of the poles of the battery being placed at the nape of the neck. But in using this remedy, we ought to be certain, above all things, that we are really using electricity. Such applications as "electric brushes" and the like, do not produce electricity, and are of no service whatever. A Pulvermacher's "chain band," which is a truly electrical and scientific apparatus, is a handy means of applying electricity where this agent is employed in the cases we have described.

HAIR-TROUBLES AND THEIR REMEDIES.

Occasionally baldness is confined to patches or circles on the scalp. This condition—that of true baldness—is not to be confused with "ringworm," which is due to the growth of a distinct parasitic fungus, and which, moreover, is infectious or contagious. True or ordinary baldness may affect localized portions of the scalp, and is due to those causes to which we have already alluded. Some nervous affection lies at the root of these localized affections, where special tracts of hair appear to suffer. Possibly the primary cause might be referred, with every probability of correctness, to conditions which affect the hair-nourishment. These circumscribed spots of baldness are more frequently seen in women than in men; and it has been noticed that they often accompany persistent headaches—the close relation between the nervous system and the hair, being thus proved anew. In young children, these special bald spots are to be found, and more especially where the patients are in weak health, and require good food, fresh air, and tonic medicines. In such cases, the sensibility of the scalp seems to be partially lost over the affected region, while the circulation is deficient. As regards treatment, as just indicated, the restoration of the general health is the main point deserving primary attention. Authorities recommend that as regards *local* treatment, the bald places should be painted over twice a day with *tincture of iodine*, this process being carried out till the scalp shows signs of irritation. If more severe measures are required, the *tincture of Spanish fly* should be painted over the spot, but the lotion should be washed off in from twenty minutes to half-an-hour after being painted on the head. The aim of this treatment is that of stimulating the nourishment of the scalp, and of favouring the activity of the hair follicles. Electricity,

in such cases, applied with the positive pole at the nape of the neck, and the other at the bald spot or spots, is also regarded as serviceable by its action on the skin-nerves and on the blood-vessels. A lotion which is also serviceable where the foregoing applications may fail, is composed of one ounce each of aconite liniment, ammonia liniment, camphor liniment, and chloroform. This is to be applied daily to the bare patches. When hair-growth appears to commence, it must be kept short for some time.

For the baldness of old persons, there is, naturally, little to be done. A soft brush used night and morning to the scalp, and the lotion last-mentioned, are the measures most likely to prove of service.

Amongst the only too common troubles of the hair, *dandruff* or *dandriff* is perhaps that most frequently met with. The name arises from the resemblance of the scurf-like scales to bran. It should be known, firstly, that dandriff is itself, as often as not, a symptom of other hair troubles, and not the primary disease. The causes are very numerous. Primarily, carelessness, in the treatment of the hair, neglect of cleanliness, infrequent brushing (with a soft brush), the use of a *too hard* brush, general ill-health, &c., are known to cause dandriff. Extreme dryness of the scalp is also a cause of this affection. Persons who perspire largely by the scalp, and whose hats are not ventilated, are also frequently troubled with "scurf." *The use of a small-tooth comb* must be added to the *causes* of dandriff, for this instrument, which should be abolished from the category of toilet-instruments, simply scrapes off the outer cells of the scalp, and irritates the hair follicles. In common cases, avoidance of the above-mentioned causes of dandriff, and the addition of some simple pomade (already described), together with the use of a soft brush, will often cure this affection. A little bay rhum, applied to the scalp with a soft sponge, is also to be commended.

The *sebaceous glands* of the skin have already been alluded to

in the course of these articles. These glands open into the sheathes of the hair, and supply an oily matter which apparently contributes to their nourishment. The Latin term *sebum,* from which the name of these glands is derived, means "fat" or "suet." Occasionally it would appear that these glands are subject to over-stimulation. The chief ailment in the production of which these glands are involved is known as *stearrhœa* —literally, "a flowing of fat." The secretion of the glands—not merely of the scalp, but of the skin generally—is poured out in excess, and tends to form a greasy layer, which is as often seen on the face itself as in the scalp. The treatment of 'greasy head" consists, firstly, in the softening of the fatty crust by the free application of oil—vaseline, sweet, or cod oil—and in its removal thereafter by the use of soap and warm water. Thereafter a wash, of the strength of four or five grains of tannic acid to the ounce of water, will be found efficacious. In very obstinate cases, a cold starch poultice may be required to clean the scalp. Such cases as that just described are invariably associated with general health disorder. The correction of this general bodily weakness is, therefore, absolutely necessary to prevent the continuance of the disease.

In those who are badly nourished, and who suffer from any exhausting disease, the secretion just described as causing disease by excess may be deficient. In the latter case the hairs are liable to be prevented escaping from their follicles. The result is, that the confined hair remains to form a swelling, and considerable itching and irritation follows. In some cases the hairs have a powdered appearance, due to want of nourishment, such a condition being most commonly seen in women and children, in whom crimping, curling, and other processes of hair-torture are common. The treatment of these latter conditions is simple in the extreme. The use of soap and water, and of a moderately-hard brush, will relieve the symptoms, whilst the dryness should be corrected by the use of simple pomade. An ointment of three drachms citrine ointment to five drachms

benzoated lard, applied daily to the scalp, will be of service where the deficient secretion of the sebaceous glands causes the irritation already described.

A very troublesome, and one may say, hydra-headed affection of the skin, is that known as *eczema*, popularly spoken of as "milk crust." This affection is marked by the development of small pustules on the skin, and constitutes, indeed, the most common of skin troubles. The interest which this disease creates, in relation to the hair, can be understood when we find that the hair is involved in the abnormal state of the skin, and that the matter discharged from the eczema pustules will cause the hair to become tangled, knotted, and weakened. In young children, especially, the scalp may become a mass of sores and matted hair, and, if neglected, the disease entails subsequent hair weakness, if not baldness itself.

Such cases are difficult of treatment. There is a liability to relapse, which often defies treatment; but much may be done to alleviate the disease, and to effect a cure. The "general health" aspects of the case come prominently to view under such circumstances. All weakness of the system at large, blood-disorders, digestive troubles should be attended to without delay. Correction of such constitutional errors forms half the battle in the treatment of eczema. For local applications to the scalp, the first process consists in the thorough cleansing of the head with warm water and Castile soap. For a few days thereafter, some simple oil-dressing should be used. Then the following ointment may be applied, morning and night, after the scalp is washed:—tar, 1 oz.; oil of white birch, 1 drachm; lard, 1 oz.; simple ointment, 1 oz. It should be added that as this application stains the clothing, a cap should be worn. The matted hair should, when much involved, be clipped short. A favourite powder, which may be dusted on the scalp, in such cases, is made of camphor, 1 drachm; oxide of zinc ointment, 1 drachm; starch, 1 oz.; and alcohol, a sufficient quantity. If the foregoing remedies fail, they may be used alternately

with a lotion which has been found useful in cases of hair, troubles of the kind alluded to, and which consists of dilute prussic acid, 1 drachm; sub-nitrate of bismuth, 2 drachms; rosewater and glycerine, of each, 2 ounces.

A very troublesome affection, liable to be confused with certain parasitic diseases of the skin, is that known as *sycosis* of the chin, sometimes as "false barber's itch." On the skin in this case, pustules form, a hair being involved in the centre of each. The affection may extend to the face generally, and to the eyebrows. This affection is confined to the hairy parts of the face, whilst the eczema already mentioned affects the skin at large. The treatment for these troubles of the beard and hair resembles that of eczema. The crusts and matter are to be removed by the free application of oil and soap-washing; then the hairs are to be pulled out of the affected parts, an operation which, owing to the loosened state of the follicles, will not be of a painful nature.

The ointment, consisting of flowers of sulphur, 1 scruple; iodine, 10 grains; and oxide of zinc ointment, $1\frac{1}{2}$ ounces, should then be applied to the affected parts twice daily. Later on, the simple oxide of zinc ointment itself may be used as a healing application. A common hair and skin trouble is that known as *Acne.* Here, the sebaceous follicles become filled with their secretion, and the tubes being blocked up, whilst the top of the plug becomes blackened, the face comes to appear spotted. The little white mass with the black head, which can be pressed from each follicle, is the impacted sebaceous matter. If allowed to remain, and if inflammation sets in, the simple blocked-up duct becomes a pustule. Many young persons suffer from *acne.* The causes of the affection are to be found in the activity of the skin-glands in early life, and in the probable arrest of their secretion by some condition, of which sudden changes of temperature, chills, and the use of cosmetics, face washes, &c., are the most common.

When the face-pimples of *acne* become very troublesome and

prominent, the best form of treatment consists in opening them at the top by aid of a fine cambric needle. By this operation the imprisoned secretion is allowed to escape, and thereafter washing with hot water and soap, and friction to the skin with a towel, will favour both the cure and further the prevention of the disease. A lotion for the skin after this simple treatment may be used. The following is a favourable application :—Tannic acid, 4 drachms ; glycerine, 1 ounce ; rosewater, 1 ounce ; bay rhum, 1 ounce. To be used freely as a skin application. Those who suffer from these *acne* pimples, in which, as often as not, the hairs of the scalp may be involved, should live temperately and avoid stimulating foods. In such cases, mild aperients, such as small doses of some mineral water (e.g., "Æsculap,") will be found useful.

THE HAIR AND ITS TROUBLES.

Amongst the deformities of the human frame which cause much annoyance to their possessors, are those so-called "freaks of nature" in the shape of hair-growths in unusual places and in unsightly masses. The growth of hairs on "moles" on the face, for example, and the presence of hairs on the cheeks in situations where (especially in the case of the fair sex) their development distinctly offends the laws and canons of beauty, are causes of much mental annoyance, if only from their conspicuous nature. Occasionally, such localized hair-growths are traceable to some unusual stimulation of the skin. They have thus been known to follow the application of a blister, and they are also tolerably common as affects nervous disorders, or even after an attack of general ill-health. After paralysis of the muscles, excessive hair-growth has been known to occur. Sir James Paget had a case in which the patient's left arm and shoulder, which were paralyzed, developed a thick covering of hair. In certain cases of mental disorder we see the same

tendency to redundant hair-growth. Idiots, both male and female, frequently develop a copious face-growth, and such an event only demonstrates anew the close and intimate relationship which exists between the hair and the nervous system.

One of the most remarkable cases of excessive hair-growth which has yet been reported, is given by Dr. Leonard. The case is that of Edwin Smith, of Fairfield, Michigan. At forty-five years of age his beard measured seven feet in length. A portrait of this man shows him in the erect posture, with his beard hanging on the ground. The longest hairs measured seven feet six and a half inches in length. The beard has grown to these extraordinary dimensions in twelve years. When he was fourteen years of age he had a heavy beard-growth, which measured six inches in length. This beard was shaven, and when he attained maturity he kept his beard about six inches long. Curiosity impelling him to allow it to grow, the result was seen in the enormous beard already mentioned.

The treatment of cases in which a growth of hair becomes localized and unsightly, is a somewhat delicate and difficult matter. It is as well, at the outset, to state plainly that many of the so-called "depilatories," or hair-removers, are ineffectual; whilst, if they do remove the superfluous hairs, they cannot affect the *papillæ* from which the hairs spring, and hence the use of these depilatories is followed by temporary relief only. Again, in the employment of depilatories, *great care should invariably be exercised.* The use of these substances, even the most harmless, is apt to affect the skin. Accordingly, the directions for the use of these substances should, in all cases, be attended to with strictness. In no case should they be used unless their employment is imperatively demanded.

For the removal of hair generally, a lotion composed of equal parts of liquor potassæ and alcohol may be brushed over the surface at night, and removed in the morning by aid of a tepid bath, with plenty of soap. Used carefully, this lotion

does not appear to injure the skin. Of course, it does not touch the hair bulbs, so that a fresh growth of hair will sooner or later take place. Boudet's formula for a depilatory consists of sulphate of soda three drachms, quicklime ten drachms, and starch ten drachms. These ingredients are to be placed, mixed, in a stoppered bottle. A little water should be added to a portion of the powder so as to make a paste, and this is to be applied with a wooden spatula over the part. After being allowed to remain for five or ten minutes, or until the skin begins to smart, it is to be scraped off and the part washed with warm water, after which some powder may be dusted over the affected spot. Another depilatory is composed of quicklime two drachms, carbonate of soda three drachms, and simple ointment two ounces. Apply as in the case of the preceding depilatory. The depilatories sold in the shops frequently contain arsenic, but the use of this corrosive substance is highly objectionable.

By means of an electrical apparatus, hairs can now be removed in a satisfactory fashion, more especially as in this procedure the roots of the hairs are destroyed. The hair is partially withdrawn from its follicle, and a needle connected with a battery is thrust into the follicle, and allowed to remain for a second or two. In this way, the hair-papilla is destroyed; and as many as 160 hairs have been successfully treated in this way in about half-an-hour. A simpler method, in which electricity is dispensed with, is that of forcing a special needle into the hair-follicle, and of breaking down the growing point of the hair. A little inflammation naturally succeeds such an operation. Chloride of zinc solution (a cauterizing fluid), of the strength of two drachms to three drachms of water, has been injected into the hair follicles with a fine syringe, one drop being placed in each sac. Lunar caustic (nitrate of silver) has also been employed as a depilatory, being used on the point of a needle, which is thrust down into the sacs of the hairs.

A topic which certainly verges on the needless and the frivolous, but which must yet be treated in the present series

of papers, is that of the alteration of the colour of the hair by dyes. There are few considerations entitled to any weight whatever, from a scientific, social, or æsthetic point of view, which can be said to justify the practice of altering the natural hue of the hair. What fashion decrees, it is, however, only too certain, crowds will follow, leaving all considerations of health and well-being out in the cold. But the topic has at least its health aspect. We have to warn those who indulge in such practices, of the probable evils which await their playing fast and loose with hair-dyes and cosmetics. These, as often as not, contain substances eminently injurious both to skin, hair, and to the general health. But to this important social subject we must devote a special chapter.

HAIR-DYES.

Fashion, against the rule of which even kings are powerless, and science unable to stand, has now and then included the colour of the hair in the list of bodily circumstances which it is deemed desirable to alter. Hence arises the demand for hair-dyes and for lotions capable of altering the hue of the hair to the tint which Dame Fashion declares to be that most "æsthetic," or, what is much the same thing, most in vogue for the time being. Occasionally there may arise a demand for a hair-dye which partakes of a rational nature. A young man or woman may be troubled with a patch of hair which grows persistently white amidst the surrounding and raven tresses. The natural desire to avoid anything which is conspicuous in our personal appearance might legitimately enough lead us to desire that such a peculiarity should be modified or cured. In such a case, the use of a dye would be not only a thoroughly rational procedure, but, if a proper dye be used, a perfectly justifiable act, as much so, indeed, as the removal of a disfiguring scar by a surgical operation, or the extirpation of hairs growing in unusual

situations. The following remarks, quoted from my "Leaves from a Naturalist's Note-Book," may prove somewhat *à propos* in treating of the fashionable follies of the day in the matter of hair-dyes and kindred inanities :—

"Treading closely on the footsteps of the patent medicine vendor, we find the proprietor of chemical wares which are destined—so runs the announcement—'to add to the armamentarium of the toilet-table,' and which in their nature may be often harmless, but occasionally deleterious, as every physician can attest. What is to be said of the innumerable dyes for the hair and washes for the skin which are advertised broadcast? Apart from the moral and æsthetic aspect of such 'aids to beauty,' there is the medical side, with its testimony to the evil effects of the lead lotions and other compounds used for changing the hue of the hair. Nor does the modern practice of fashionable æsthetics rest thus. Before me lies a ladies' newspaper, noted for its large circulation, and for the immense advertising supplement it weekly issues. Here I read of coiffures innumerable, of 'invisible foundations for covering ladies' thin partings and bald places with hair;' of 'artificial eyebrows'—these appendages being styled the beau-ideal of beauty—at twenty-one shillings the pair; of 'eyebrow pencils;' of *rouge végétal;* of a 'crême' for the complexion, 'a new discovery for imparting a healthy (*sic*) white or pink (*sic*) tint to the complexion;' of processes for 'effacing wrinkles,' whereby (shade of Rachel) 'the skin becomes fresh and diaphanous' (*sic*); of 'an invaluable powder warranted to whiten the most discoloured teeth;' of other 'crêmes' (sent by post safe from observation) warranted to give a 'youthful complexion' to faces of any age; of ladies who devote their time and talents to 'getting up the *face* and *eyes* in the most brilliant style'—one professor of this art confessing to having been 'a lady's-maid in the highest circles of England, Paris, and Spain.' All these I read with astonishment; and I begin to ask myself whether or not I live in an age when physiology is taught in schools, and in which Charles Kingsley wrote, and whether or not such

contrivances for ruining health and burlesquing life are used by the fair sex to the extent that our ladies' newspaper would seem to indicate? It is certainly a marvellous age in its inventive fulness and profusion of arts wherewith an unkindly nature may be assisted and improved. But that the *morale* thus indicated is neither æsthetic, scientific, nor praiseworthy in any sense, is a conclusion in which I imagine most sensible people will concur; whilst the general prevalence of the remark, 'sent safe from observation,' in the advertisements of the vendors of the toilet articles above mentioned, would seem to indicate that the knowledge of their use is a matter not for the many, but the initiated and beautified few.

"Turning to the physiological and scientific aspects of medical by-ways, we may possibly find means to arrive at some conclusion respecting the probable effect of this unauthorized drugging of people, which common observation demonstrates to be of such widespread occurrence and practice. Firstly, let us glance at what, for want of a more suitable term, may be called the æsthetic aspects of those minor by-ways into which popular chemical investigators lead those whose complexions, faces, or figures may demand amelioration at the hand of art. That the beautifying or improvement of the person under certain circumstances is a perfectly legitimate procedure when judged by the commonplace rules of society, is a conclusion which demands no evidence by way of support. No one would dream for a moment of disputing the assertion, to come to personal details, that a defacing wart, mole, or wen on the face, capable of being readily removed, without danger, by surgical interference, should be so disposed of. And to take the very common and exceedingly annoying case of a profusion of hairs attaching themselves prominently, say, to some simple skin-growth, and capable of being permanently or even temporarily removed by depilatories, the same remark holds good. Such acts of personal attention need no excuse. On the ground of common personal æsthetics, apart altogether from the freedom of annoyance from marked blemishes of face or figure, the amelioration of such

deformities is a bare act of justice to the individual in question. The removal of a blemish is physiologically as defensible a proceeding as the replacement of missing teeth by the aid of the dentist, and in this latter act we find the truest warrant, since, for digestive purposes, the possession of teeth, or their artificial substitutes, is absolutely necessary for the preservation of health. To the replacement of a maimed limb by an artificial one, there can be still less objection. The common ground of expediency, utility, and function, presents us with an unanswerable argument in favour of the work of aiding nature, in so far as we are able, by the devices of ingenious art.

"Very different, however, is the argument which would fain carry these same reasons into the domain of the peruke-maker, and into that of the manufacturer of face-paints and lotions. On what grounds, æsthetic or otherwise, could a change of colour in the hair be demanded or defended? Similarly, on what grounds could we justify the practice of face-enamelling, or the smoothing out of the wrinkles which time writes naturally enough on our brows and faces at large? It cannot be argued that a false eyebrow or curl is as justifiable as false teeth, for the purpose of the latter as aids to digestion is plain enough; whilst the only conceivable ground for the adoption of the former appendages would be an 'improvement in looks'—an avowedly small-minded excuse, and one, in any sense, of doubtful correctness. To the deficiency of want of eyebrows we become accustomed, as to the whiteness of hair or other peculiarities of *physique;* but if the practice of supplying nature's defects—justifiable enough under certain conditions, as we have seen—is to be regarded as legitimate under all circumstances, the extremes of absurdity to which such a practice may and does lead are readily enough discerned. Admitting the false eyebrow, why should we exclude the 'nose machine' advertised for the charitable purpose, when worn daily (in private), of altering the unbecoming natural style to that of a becoming and, it is to be presumed, fashionable olfactory organ? "Of the deleterious effects of the continued application

of the fashionable lotions and varnishes for the face, medical science is not slow to testify. Few readers can forget the exposures in the famous Rachel case; or the testimony then and at other times offered, to show that such 'preparations' for the toilet are made, as a rule, to sell and not to use. Let Dr. Taylor, in the name of authority, speak concerning the effects of common hair-dyes. 'Cosmetics and hair-dyes,' says the same author, 'containing preparations of lead, commonly called hair-restorers (!) may also produce dangerous effects. I have met,' he continues, 'with an instance in which paralysis of the muscles on one side of the neck arose from the imprudent use a hair-dye containing litharge.' These hair-dyes, or 'hair-restorers,' are sometimes solutions of acetate of lead of variable strength in perfumed and coloured water. In other cases they consist of hyposulphite of lead, dissolved in an excess of hyposulphite of soda. In one instance, the continued use of such a dye is reported to have proved fatal, and lead was found in the liver, and in one of the kidneys. 'Mr. Lacy,' adds Dr. Taylor, 'has pointed out the injury to health which is likely to follow the use of white lead as a cosmetic by actors.' Doubtless 'preparations' do exist, in which the metal in question is absent; but in any case, the want of certainty as to the composition of the substance, should, in itself, serve as a condition inculcating caution and suspicion in regard to the use of such nostrums."

We may discover in our next that whilst the use of all dyes is unnatural, and whilst most dyes exert anything but a healthy action on the hair, there are several which may be mentioned as less injurious and as less noxious than the compounds commonly sold.

THE HAIR AND HAIR-DYES.

The practice of dyeing the hair appears to be one of very

ancient origin. In classic times, the practice was well known, and amongst certain Eastern tribes it is still regarded as a duty to dye the beard and hair. The Mohammedans dye hair and beard of a reddish-yellow hue as a kind of religious rite. There is one caution which should be universally borne in mind in dealing with the topic of hair-dyes—namely, that care and caution must be exercised in their use when that use is justified by any of the circumstances to which allusion has been made in previous papers. Where a fashionable craze sets in for blonde hair, and where the vain and silly units among the female sex attempt to imitate such a hue, the caution just given is needless. In this case, no considerations, either of sanitary or common-sense kind, are likely to weigh with the slaves of fashion. Or when an elderly beau, who is ashamed of the white locks which should be a sign and token of respectable and respected age, and who seeks to imitate the raven tresses of his youth by dyeing the few hairs he may still possess, insist on using dyes, it is possibly worse than useless to remonstrate. Such persons live outside the pale of a reasonable existence, and, at all risks, they will use whatever mixtures or lotions they can be assured will produce the desired effect.

As a rule, the common hair-dyes contain lead in one form or another. Others contain nitrate of silver (lunar caustic), and some have sulphur as a constituent. A few contain iron in one form or another. As regards the lead dyes, a solution of iodide of potass added to a fluid containing lead will throw down the yellow iodide of lead, and in the potass solution we have, therefore, a test for lead in hair-dyes. The use of lead is at the best dangerous. Symptoms of lead-poisoning, as detailed in our last paper, have followed the use of such preparations, and it is a familiar fact that certain persons exhibit to lead a peculiar idiosyncrasy which renders them highly susceptible to its action. Against the use of lead dyes we should, therefore, caution our readers. If it is necessary to use dyes at all, there are many safer preparations which can be depended on to serve all the purposes for which lead is employed. A preparation

which has now and then been used for staining the hair is the juice of the green rind of walnuts. As is well known, this fluid stains the skin. Its action on the hair is alleged to be that of "restoring" the colour. We are inclined to be somewhat sceptical of this action, however, inasmuch as, when added to hair which was originally dark, walnut-juice simply stains the hair, and such a result may readily enough be confused with a veritable "restoration" of the pristine hue.

Where it is desired to produce a black hue in the hair, the following lotion will be found useful:—Nitrate of silver, from 10 to 30 or 40 grains; distilled water, 2 ounces. This solution will require to be kept in a coloured or darkened bottle, so as to guard it from the light. It is to be applied so as to wet the hair thoroughly, and, if the result is to be hastened, the application of the following lotion may be recommended for use after the first:—Sulphuret of potass, 1 to 6 scruples; distilled water, 2 ounces. As a hair-darkener, the lotion which follows may be recommended as by no means of injurious nature:—Sulphate of iron, 1 drachm; alcohol, 1 ounce; oil of rosemary, 12 drops; water, half a pint. This should be applied frequently to the hair. A black dye is formed of the following ingredients:—Citrate of bismuth, 1 ounce; rose water, 2 ounces; distilled water, 2 ounces; alcohol, 5 drachms; and ammonia, a sufficient quantity. This is to be applied to the hair, if possible, 8 or 10 hours before the second lotion is used. The latter is composed of hyposulphite of soda, 12 drachms, and distilled water, 4 ounces. It should be added that when dyes are applied to the hair it must be washed free from oil, and should be well-dried. When the dye has been applied and allowed to fix itself, a little simple pomade of any kind should be applied, so as to prevent undue dryness of the hair.

Where a *brown* hue is desired, a preparation composed of sulphate of copper 16 grains, and 4 ounces of distilled water, should be first applied to the hair; and, as soon as this is dry, a second lotion of ferrocyanide of potass, 16 grains, and distilled water, 4 ounces, should be sponged or brushed over the first.

This latter, and, indeed, *all dyes*, should be labelled "*poisonous*," and should be securely kept, like all other household medicines, under lock and key. A dark-brown dye, or even a black hue may be obtained by the use of a lotion consisting of ammonia-nitrate of silver, 1 drachm, and distilled water, 4 ounces; but this preparation, it should be noted, stains the skin. After the lotion has dried on the hair, the following should be applied with sponge or brush:—Pyrogallic acid, 2 drachms; distilled water, 4 ounces. The permanganate of potash (seen familiarly in Condy's Fluid) will stain hair of a light brown, if used of the strength of 20 or 40 grains to the ounce of water.

Red hair-dyes are of dangerous nature, and cannot be recommended with safety. Hair is often "bleached" red; but its quality and growth are imperilled by such treatment. Of the "yellow" and "blonde" dyes, the same remark holds good. Lightening the hue of the hair involves, as a rule, a "bleaching" action, which is destructive to the tissues experimented upon. Washing the hair in strong soapsuds and then exposing the hair to sunlight bleaches it somewhat—a result more certainly brought about when a weak solution of caustic potash is employed. Chlorine, sulphurous acid, and nitric acid, have also been employed in bleaching the hair to a yellow hue. But we have delayed long enough over the topic of dyes. Our final advice to all concerned may well be to avoid dyeing the hair at all, for the process is never undertaken without some attendant risk. As a matter of necessity, and to avoid appearing conspicuous, we may have occasion to alter the hue of the hair; but there can be no justification whatever of any such practice undertaken for the sake of "following fashion," or other such reason. Persons who dye their hair are as likely as not to end their experimentation with the anything but gratifying result of having no hair to dye.

THE CARE OF THE BEARD.

The texture of the hairs which form the beard differs entirely from that of the hairs of the head and body generally. Microscopists tell us that the eyelashes and beard-hairs are the coarsest in the body—a fact which, as regards the latter at least, can readily be confirmed even by naked-eye inspection. In their growth, the face-hairs resemble those of the head; but the influence of continual shaving or cutting on the quality of the beard-hairs is possibly very great. This much, at least, appears tolerably certain—namely, that the beard which has never known scissors is of a finer and more silky texture than that which has been allowed to grow after, it may be, a lengthened period of shaving or trimming. It has been calculated that the human beard grows at the average rate of six or six and a half inches per annum; whilst one estimate sets down the total length which is removed during a lifetime of eighty years at eighty feet. There are wide differences perceptible in the growth of the beard amongst the various races of mankind. It is found that the beard, as a rule, attains its greatest development amongst the light-skinned and light-haired races; but the conditions which result in the presence or absence of the face-covering are probably far more complex than might at first sight be imagined.

Doubtless fashion, or habit, and work, will largely dominate the particular style of face adornment seen in the sterner sex. Individual peculiarity or predisposition may favour the growth of the beard in one person, and may dispense with the beard in another. The military service favours the moustache, but eschews the beard, whilst in the navy growth of the beard and whiskers is by no means countermanded. Again, certain of the professions have from time immemorial tacitly adopted a particular style of hair-dressing. Long ago, the legal countenance was a literally "bare-faced" one, and, in many respects, the lawyer and the actor still agree in the total absence of face-

hair. The neatly-trimmed side-whiskers of the barrister are still to be seen, although the rule has of late years been often broken through, and beards and whiskers may be seen in plenty beneath the forensic "horsehair." The medical profession, also, used to appear in shaven chin and upper-lip, the "professional whiskers" being also duly trimmed; but of late years, this fashion has altered very considerably, and doctors, like the lawyers, appear to have admitted the beard as a thoroughly rational element in the personal belongings of the profession. The idea of "the priest all shaven and shorn," embodied in the nursery rhyme, shows us that the clergy in like manner long ago adopted a very distinctive style of face-decoration. To this day we may, as a rule, distinguish the High Churchman from his Broad Church neighbour by the complete absence of face-hair; and the priesthood of the Roman Catholic Church naturally follow what appears to be a very ancient custom in their free use of the razor. The growth of the moustache, according to the ideas of some writers, dates—in America at least—from the visit of Kossuth. In Great Britain the growth of the moustache received a certain impetus from the initiation of the Volunteer movement. At least, this fashion became more common after the enrolment of the citizen army than before. As a typical military fashion, the habit of moustache-growing would not unnaturally become associated with the movement in question.

Personal objections to the growth of the beard and moustache have been founded on the score of cleanliness and convenience; but these objections will not, of course, hold good in the eyes of thousands. There is, at least, one powerful argument in favour of the growth of the beard and whiskers, which may well serve to counterbalance any objections which may be entertained on the score of fashion or prejudice. This is the health-argument, which maintains that continually recurring diseases of throat and chest are prevented by the warmth and protection which the beard affords. There can be no doubt regarding the genuine character of this argument. Numerous

testimonies can be had regarding the beneficial effects experienced after allowing the beard to grow. Cases of persistent sore throat, inflammation of the tonsils, or quinsy, bronchitis, head-colds, ear-aches, and other troubles, which owe their origin to the too familiar "cold" or "chill," have disappeared in afflicted subjects when the beard has been allowed to grow. This result can be perfectly understood when we take into account the increased warmth and protection which the beard is the means of according to the face and throat. Hence, it is a matter for the consideration of those who are much subject to throat and chest complaints whether they should not avail themselves of the means which nature provides for the protection of the face and neck.

The practice of *shaving*, in which many persons indulge, is often attended with considerable discomfort. For "easy shaving," a keen razor is, of course, an absolute necessity, and many persons unwittingly injure the skin to a great extent by the practice of "scraping" it with a razor which, like the proverbial instruments, has been "made to sell, and not to shave." The constant use of a blunt razor results in the irritation of the skin, and in the frequent outbreak of annoying pimples which distress the shaver. We should strongly recommend all shavers to possess a set of seven good razors, and having duly labelled them corresponding to the days of the week, use one each day. By such a practice, it will be found that each razor will keep its edge, with a little stropping after use, for a very long period of time; for razors, like animate things, appear to lose "tone" by too frequent use. We have lately used with success a most admirable invention, in the shape of the "Cowvan's Canton Strop" of Messrs. R. Hovenden and Sons, of Berners-street, London, W. This strop possesses four distinct sides, used respectively for grinding, setting, stropping, and finishing, and when far removed from the cutler, the shaver may have the satisfaction of being able to keep his razors in constant good trim. A supply of the "Razor Paste" sold by the same firm keeps the strop in good condition.

Regarding the use of soap, it is needless to mention "Pear's Soap" (sold for shaving in highly-convenient sticks) as a most admirable invention. A little of the soap rubbed on the face produces, by the aid of the brush, a thick, creamy lather (with hot or cold water), which renders shaving extremely easy. Those who find "Shaving Creams" irritating to the skin—as some of these preparations undoubtedly are—may be recommended to try the "Glissadermos" of Messrs. Hovenden. For travellers and others, this preparation is highly useful, and as the aid of a brush is dispensed with—the preparation being simply spread over the chin with the finger—the convenience of shaving is thus greatly enhanced.

A final word may be added regarding the treatment of the irritation from shaving already mentioned. For this affection pure vaseline should be rubbed on the face at night, and if possible the operation of shaving should be omitted for a day or two. The blunt razor should be sharpened, and a little attention to the general health will cause the annoyance to disappear. The effect of a chill in cold weather after shaving with hot water is often seen in the irritation just alluded to. We would remind those who are eager for the growth of moustache and whiskers that there is no preparation (beyond such stimulating lotions as have already been described in previous papers) which can "force" them to grow on the face. Deficient hair-growth is as often as not a constitutional and general feature of the body, and depends on conditions quite beyond the reach of outward applications. Again, good health and a free circulation through the skin will often materially aid the growth of hair. But to all who might be induced to spend their money on the numerous quack nostrums advertised as efficacious in promoting hair-growth, we would say, "Attend to your general health, and refrain from wasting your money on such utterly worthless preparations."

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